After-sales Service Instructions

Testing and Repair

40
VDT-W-408/500 B

Schäfer Gasoline-Injection Pump

Type PL 004 (pneumatically controlled)

BOSCH After-sales Service Automotive Equipment

A1

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1. Introduction

This instruction manual describes the repair and testing of the Schäfer gasoline-injection pump Type PL004 (pneumatically controlled).

The construction and operation of this pump are described in Service Information VDT-I-PEU 002 B.

We recommend that this Service Information be read before a gasoline-injection pump is repaired and/or tested in accordance with this instruction manual.

In order to carry out the testing and repair work described in this manual, some special tools and equipment are required and are listed in Section 2 immediately below.

2. Tools and test equipment

Tool/instrument	Type	Type designation/ Part number
Clamping plate	92 920 010	KDEP 2743
Control thermometer	92 920 522	2742
Dial-indicator gauge	92 921 002	2751
Guide plate	92 921 005	2750
Adjustment piece	92 921 501	2753
Wrench	92 922 100	2744
Assembly tool	92 924 006	2755
Wrench	92 924 100	2745
Dial-indicator holder	92 921 003	2752
Dial indicator (Measuring range 30 mm, scale graduations 1/100 mm)		1 687 233 012
Alignment pump-head		1 688 130 141
Set of fuel-injection lines		1 680 750 065
Clamping flange		1 685 720 193
Measurement device		KDEP 2940
Test nozzle		1 688 901 993
Test-nozzle holder with nozzle		1 688 901 011
Drive coupling		1 686 430 011
Pressure gauge 0 ... 550 mbar with pressure reducer, test cap, hoses, throttle hose		1 687 232 038

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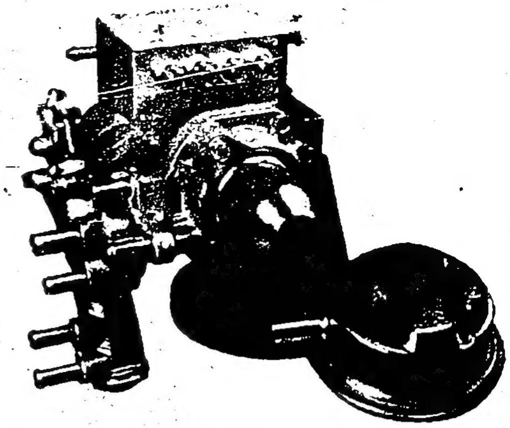
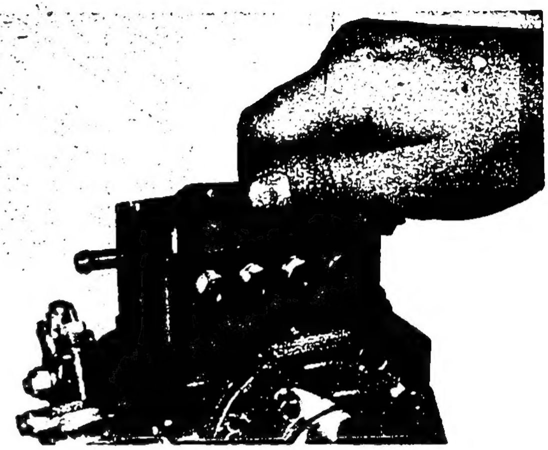
3. Disassembling the injection pump

Using the clamping flange 1 685 720 193, bolt the pump onto the clamping support so that the pump head points vertically upward.



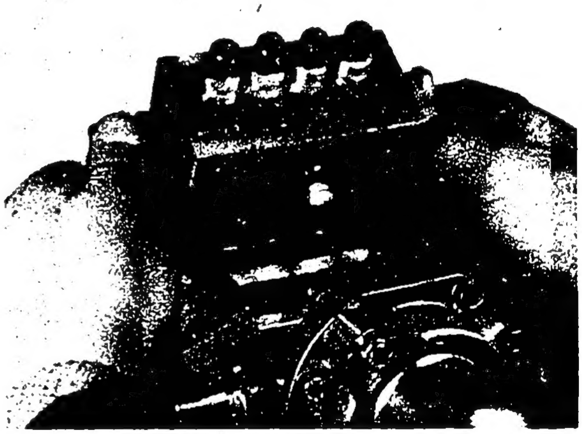
1

Remove the pump head. In order to do this, remove the four fastening screws. When removing the last fastening screw, hold the pump head against the pump housing by hand (to maintain pressure against the plunger return springs).



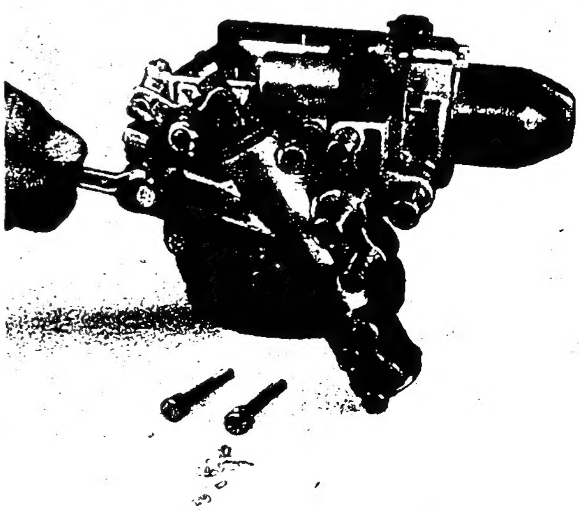
2

When removing the pump head from the pump housing, tilt it backward so that the plungers can not fall out of the bushings. Remove the pump-head seal.



3

Remove the warm-up sensor. To do this, remove the three fastening screws and remove the warm-up sensor together with the loop-ring.



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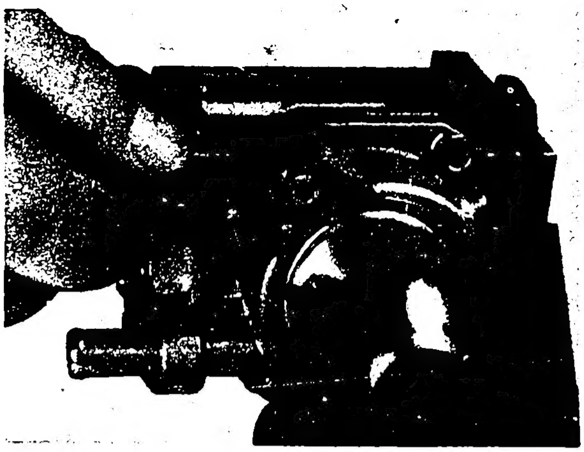
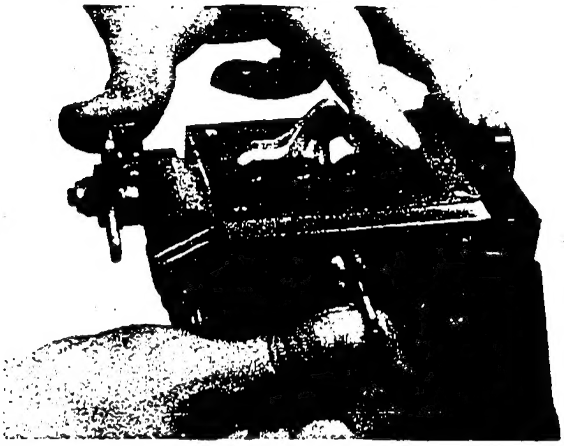

5

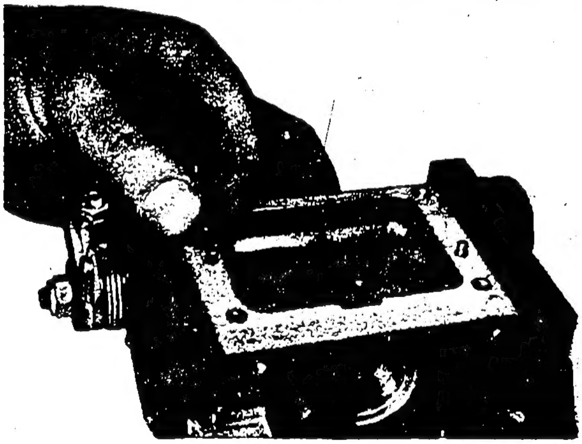
Removing the pneumatic governor

Remove the three fastening screws and remove the complete pneumatic governor. When doing this be careful of the loop-ring between the pump housing and the governor.

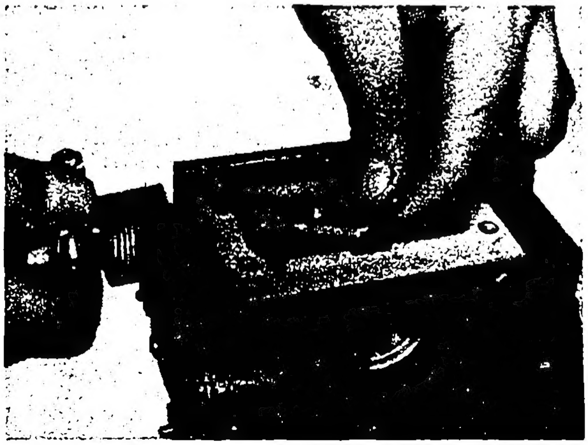

6

Disassembling the pump housing

Remove the full-load stop screw. Lift the swivel lever into a vertical position and turn the eccentric until the curve lever can be removed through the governor hole.


7

Remove the off-center stop pin which positions the eccentric shaft axially.

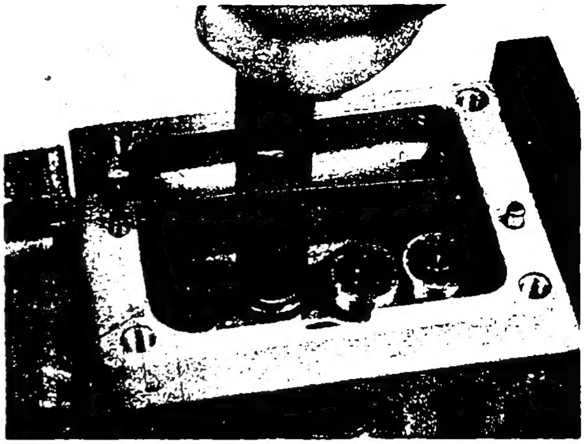

8

Turn the eccentric so that the bearing pin comes to a stop in the recess in the swivel lever. Now withdraw the eccentric from the control swivelling lever and the housing. Remove the return spring.

Remove the swivel lever upward from the pump housing.

If threaded rings are present, unscrew them with wrench 92 924 100.

Remove the plunger guide, the plunger return springs, and the plungers.

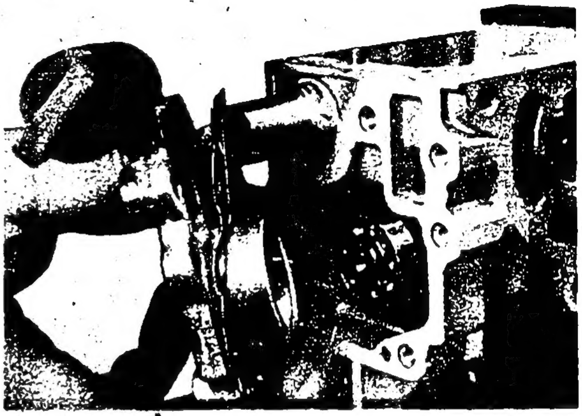


9

Release the three fastening screws holding the cover.

Take off the cover and remove the seal.

Remove the radial seal ring and the retaining ring from the pump housing.



10

In the case of pump housings **without** steel plunger bushings, the plungers must be held in the TDC position with assembly tool 92 924 006.

Remark:
Modify the tool if necessary according to the pattern of the holes in the pump housing.

Be sure that the plungers are not positioned against the camshaft by holding them up with the hook on assembly tool 92 924 006.

Using a press, press the camshaft out of the pump housing in the direction of the drive bearing.

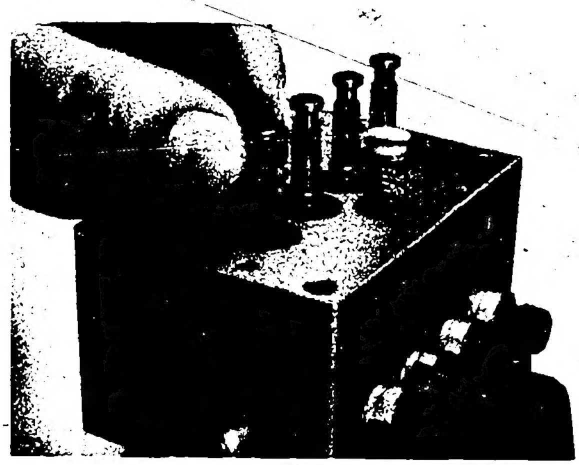
Press the ball bearings off the camshaft.

Remove the plungers with the plunger return springs from the pump housing – be careful of the steel washers between the plunger and the pump housing.

Unscrew the oil drainage screw from the pump housing.

Release the oil-level control screw and remove it.

Fasten the pump head on clamping plate 92 920 010 so that the plungers point vertically upward.

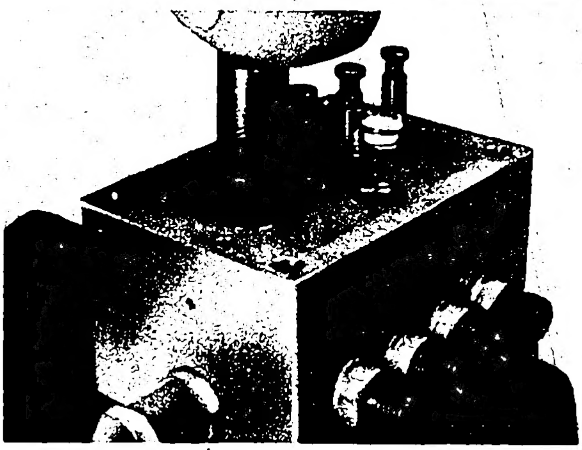


11

Remove each plunger individually from its bushing, remove the spring and spring seat, and slide each plunger back into its associated bushing.

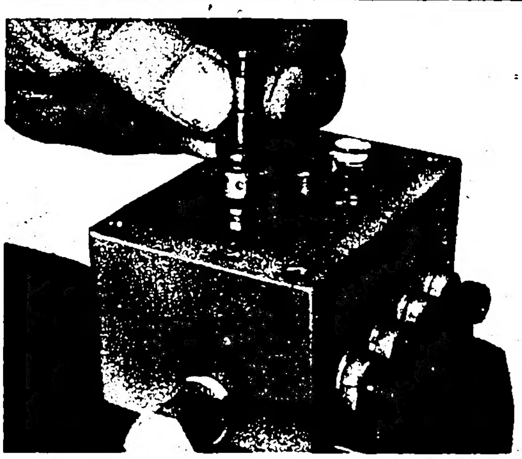
Caution:
The plungers must not be interchanged with each other!

Remove the complete conical spring from the guide hole.



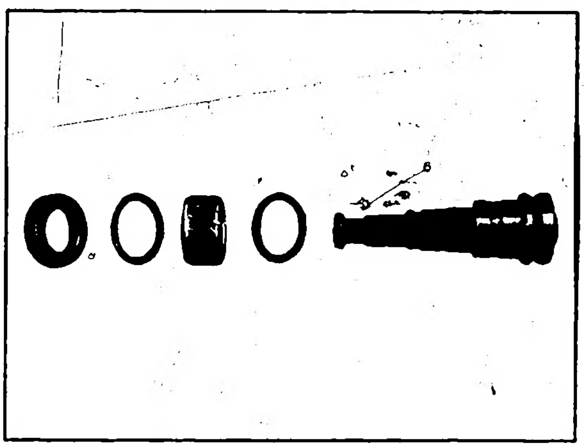
12

Using wrench 92/924 100, release the threaded rings which fix the plunger bushings in the pump head, and unscrew them.



13

Withdraw the plungers with bushings, thrust rings, loop-rings, and pressure sleeves from the pump head.



14

Remove the thrust rings, the loop-rings, and the pressure sleeves from the bushings.
Place the plungers and the bushings carefully to the side and where they are protected against dirt.

Remove the fuel feed and return screws if they are present.

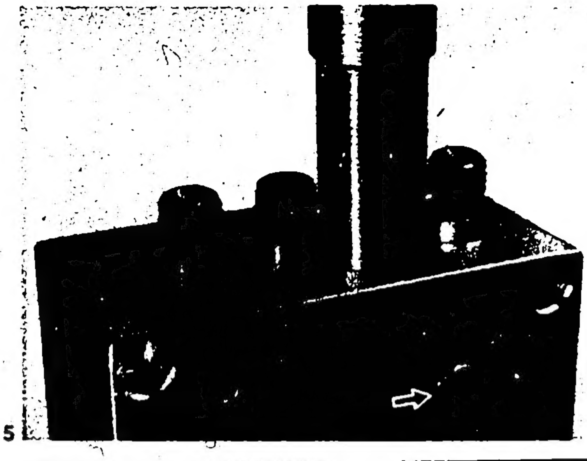
Release and unscrew the threaded rings at the delivery-valve assemblies using wrench 92 922 100.

Remove the delivery-valve assembly together with the thrust washer. The deliverey-valve assemblies can be interchanged with each other.

Release the suction valves.

Remove the valves with filter.

Remark:
The suction valves can be interchanged with each other.

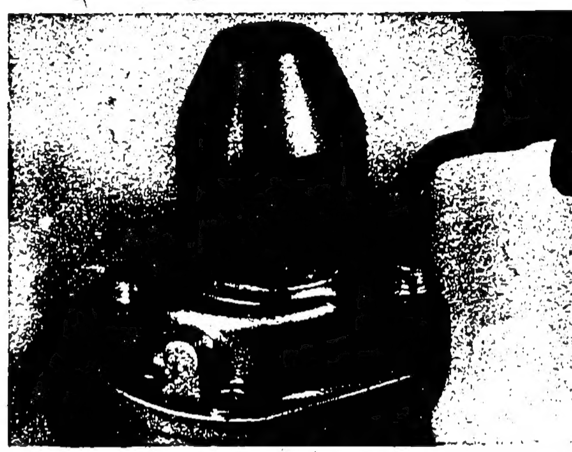


15

Disassembling the pneumatic governor
Clamp the governor in the vise so that the cap points vertically upward (use protective jaws).

Unscrew the cap.

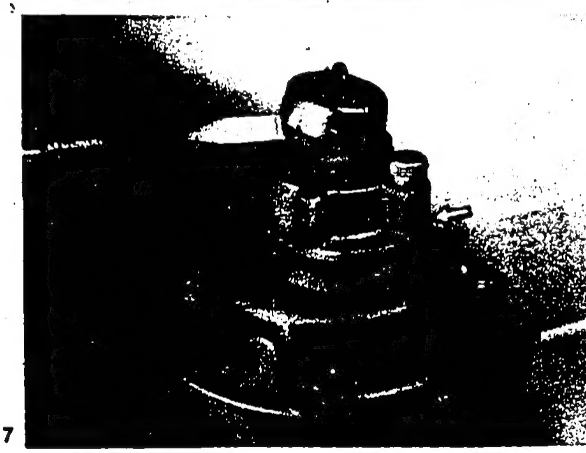
Remove the loop-ring from the housing.



16

Using a screwdriver, press the safety cap for the helical extension spring off the threaded bushing.

Release and unscrew the clamping screw which secures the threaded bushing. Be careful of the washer in the slot in the housing (arrow)!



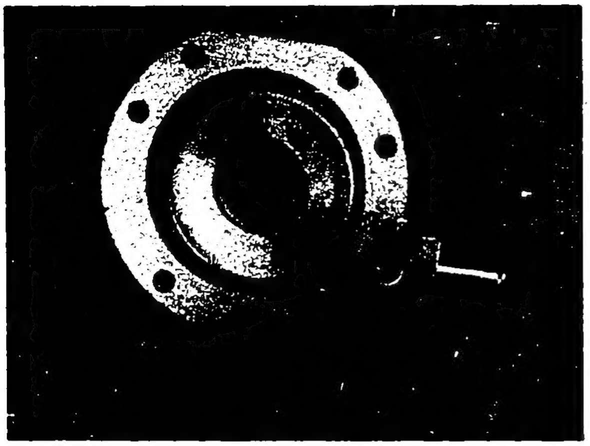
17

Hold the helical extension spring with a pair of pointed pliers and unscrew the adjustment lug from the governor housing.

Turn the governor over and clamp it in that position, then unscrew the 4 fastening screws which hold the two parts of the housing together.

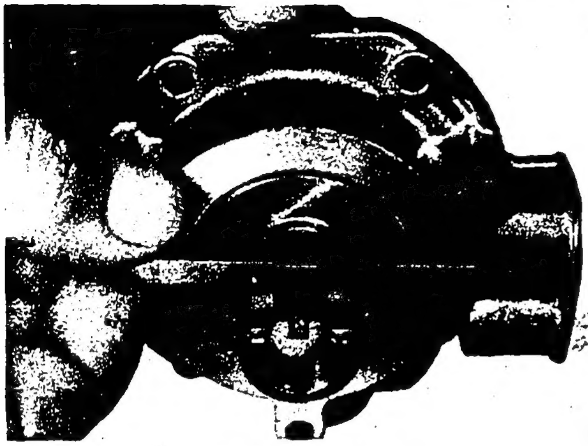
Remove the upper part of the governor housing.

18



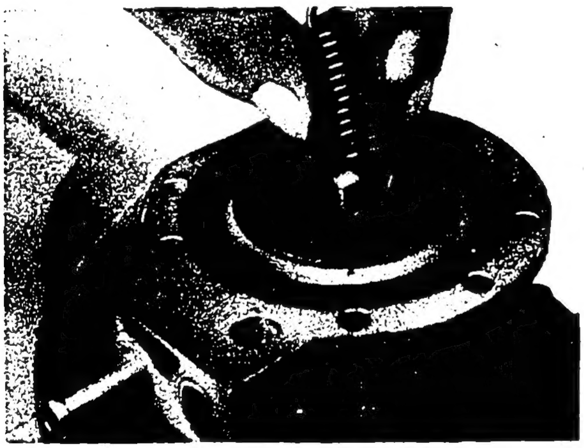
19

Remove the two loop-rings and the throttle disc from the recess in the housing.



20

Insert the nose on the positioning piece (**see Fig. 82 in Section 12** – positioning piece for ball support) into the slot in the ball support, turn the complete assembly over and clamp in the vise (see Fig. 21).



21

Unhook the helical extension spring from the spring retainer.

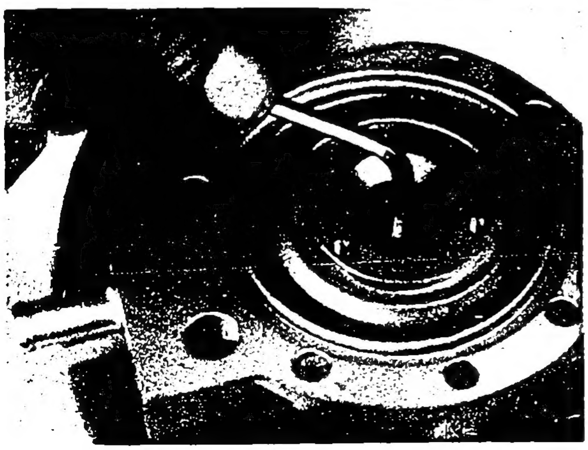
Release and unscrew the three fastening screws which hold the holding plate.

Take off the holding plate.

Remove the spring retainer.

Withdraw the plastic support ring upward.

Take off the flexible diaphragm.

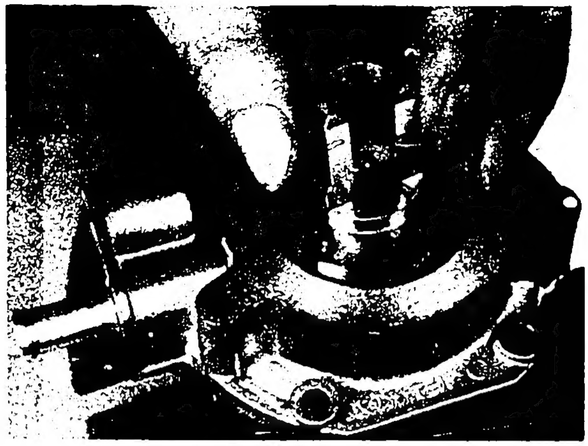


22

Release the fastening screw which connects the plunger to the ball support, and remove the plunger.

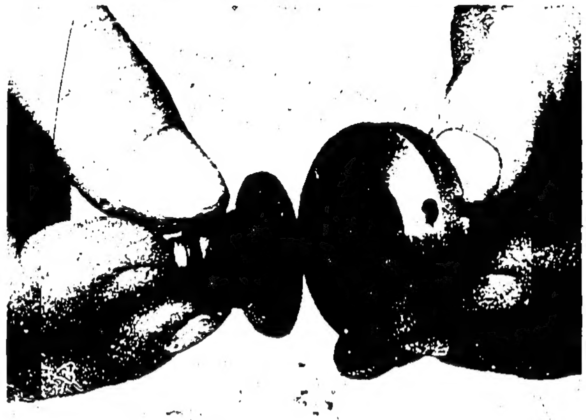
Release the three fastening screws on the ball guide.

Take the complete ball guide out of the housing.
Remove the loop-ring.



23

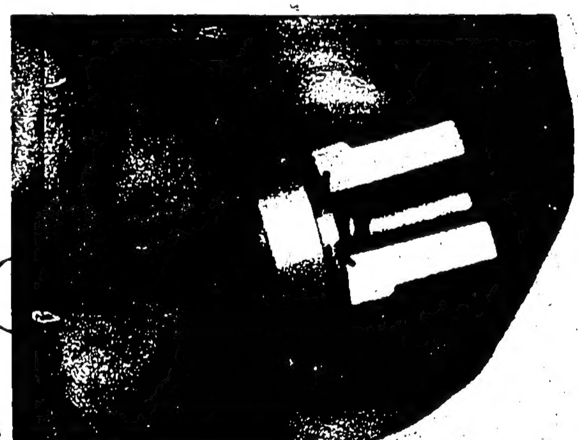
Pull the centering bushing and the flexible diaphragm off the ball support.



24

Turn the ball support so that it can be pulled off the ball guide through the retaining ring.

Remove the balls.



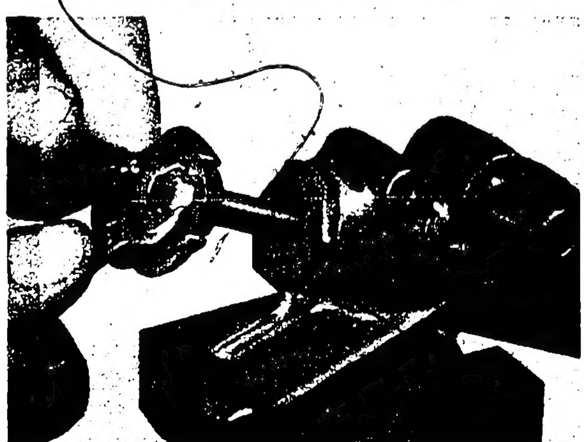
25

Disassembling the warm-up sensor

Clamp the warm-up sensor at the clamping flange in the vise.

Release and unscrew the lock nut which secures the control cone.

Unscrew the control cone from the tie rod.



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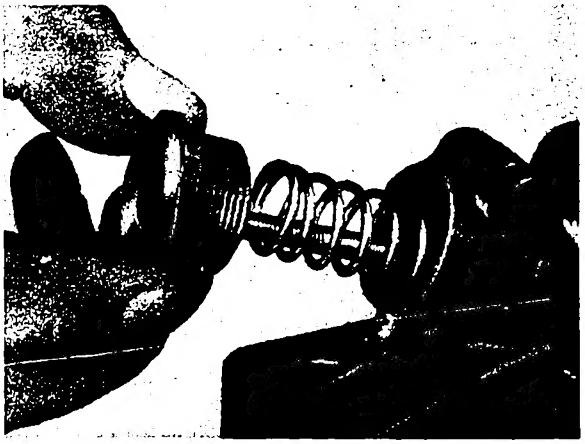
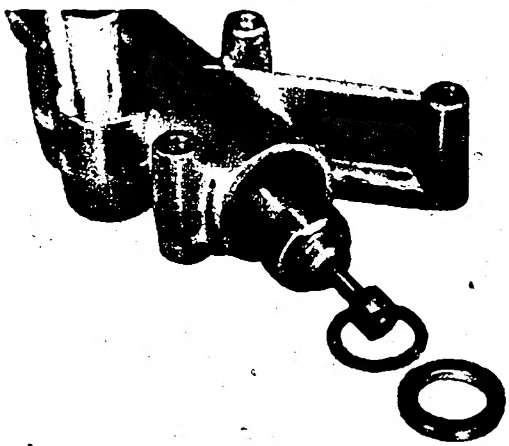

27

Release the threaded sleeve and unscrew it from the housing. When the threaded sleeve has reached the last few threads press firmly on it as it is unscrewed so that the threads are not damaged as a result of the spring pressure.

Remove the tie rod together with the helical compression spring and spring seat from the housing.

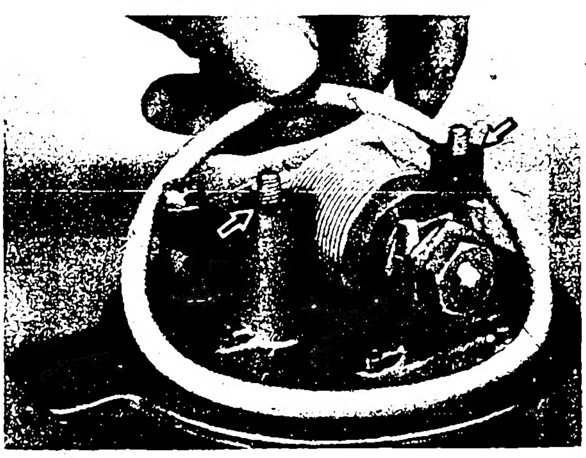

28

Remove the pressure sleeve from the housing.


29

Remove the warm-up sensor from the vise, and remove the thrust washer, the loop-ring, and the expansion element from the housing.

Caution:
Under no circumstances should the pressure pin be removed from the expansion element!


30

4. Disassembling the altitude governor

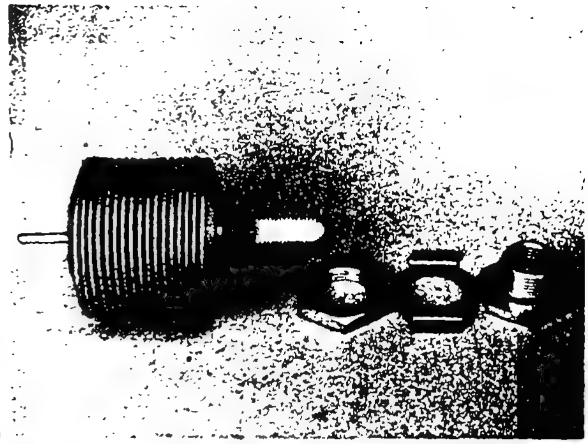
Release both nuts on the cover.

Remove the cover and the seal rings.

Unscrew the lock nut holding the barometer bellows.

Unseal and release the lock nut holding the adjustment nut.

Tilt the barometer bellows together with the adjustment nut upward and remove them.

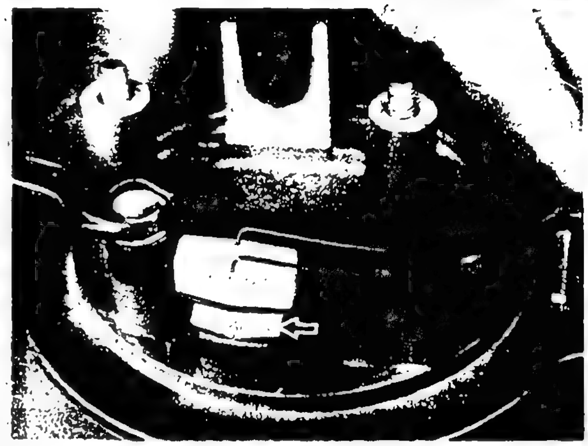


31

Unscrew the two fastening screws holding the guide piece and remove it.

Remove the slider together with the slider plate and the aperture plate from the base plate (arrow).

Clean the parts and check them visually for wear. Most important, be sure that the diaphragms have not been damaged!



32

Check parts

Wash out all individual parts thoroughly so that they are absolutely clean.

Moving contact surfaces on the pump plungers, camshaft, and sliding tappets must have no serious contact scratches.

The camshaft bearings, seals, seal rings, loop-rings, and the safety cap on the governor spring must be replaced. Check the flexible diaphragms for cracks.

5. Assembling the injection pump

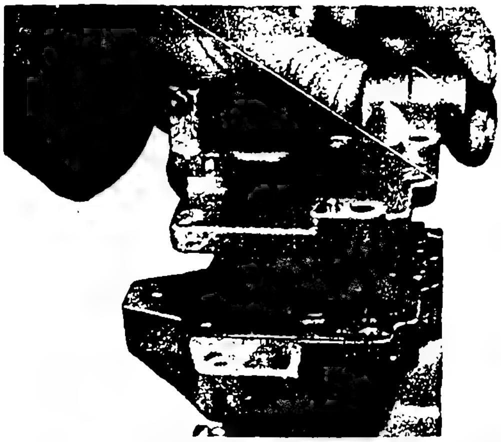
Before assembling the pump, all moving parts must be lubricated with calibrating oil and the O-rings must be coated with tallow.

The specified tightening torques are listed in Section 11.

Place the tappets and tappet return springs in the pump housing, and hold them in the TDC position with assembly tool 92 924 006.
Be careful of steel washers between the tappet return springs and the pump housing.
Press both ball bearings onto the camshaft.

Press the camshaft with the ball bearing into the pump housing from the drive side.

Place the ball-bearing retaining ring in the ring groove in the housing.
The outer ring of the ball bearing on the drive side of the camshaft must be positioned against the retaining ring.



33

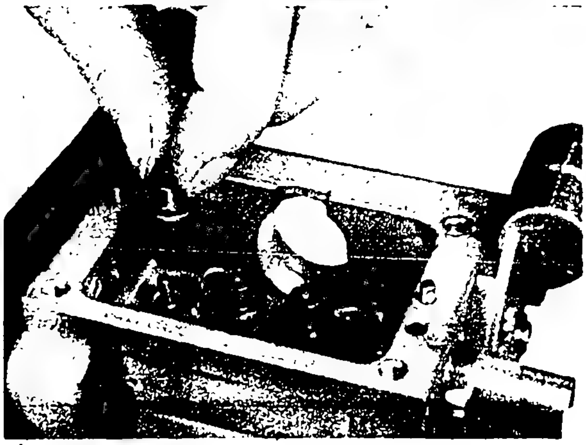
Place the cover seal on the sealing surface of the pump housing.

Press the cover with the bearing guide onto the camshaft bearing.

Attach the cover to the pump housing with the three fastening screws.

Check that the camshaft can move easily.

Press the radial seal ring over the assembly sleeve (to be fabricated by the user, see Section 12, Fig. 86) into the pump housing.



34

Screw the oil drainage screw together with a seal ring into the threaded hole in the pump housing.

Insert the sliding tappets with the plate-shaped bases through the holes in the housing and position them against the camshaft.

Slip the return springs over the tappets so that they contact the tappet bases.

Place the tappet guides with the short side downward over the tappet return springs.

Lay the threaded rings on the tappet guides.

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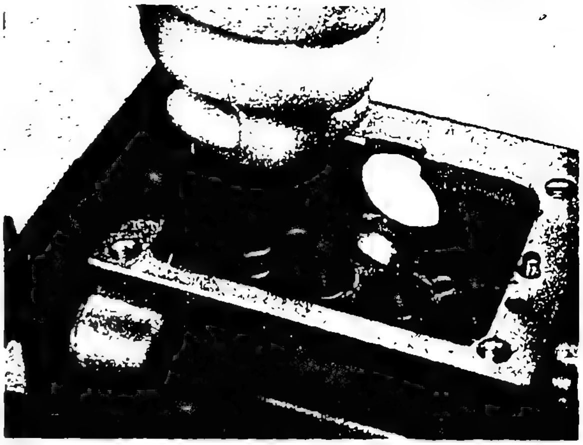
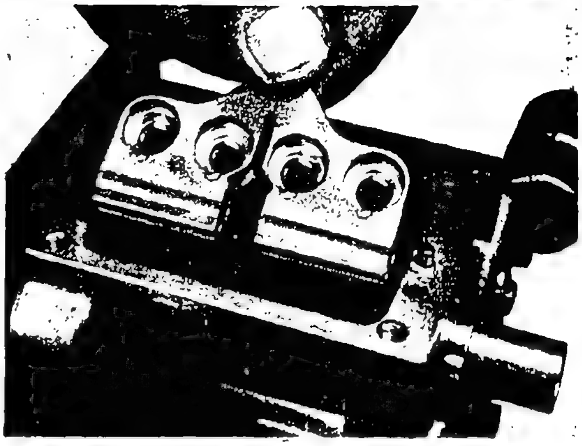
Screw the threaded rings into the threaded holes in the housing using wrench 92 924 100.



35

Place the swivel lever from above into the opening in the housing.

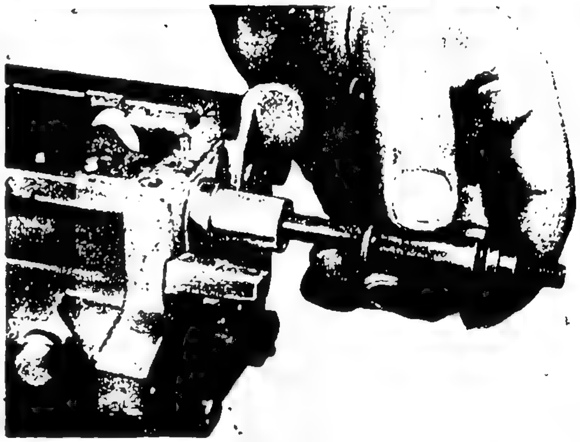
Caution:
The spherical inserts must not be interchanged.



36

Place the seal ring in the ring groove in the eccentric shaft.

Insert the eccentric shaft with the bearing neck in front into the guide bushing in the housing.



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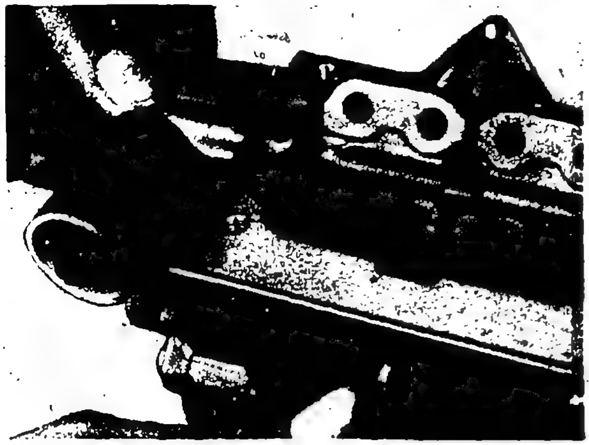

38

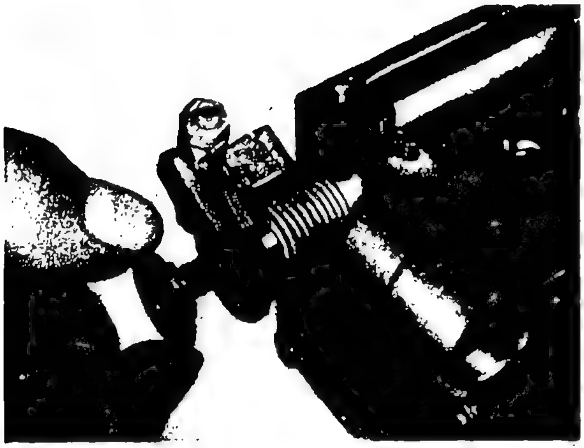
Turn the eccentric and the swivel lever with respect to each other so that the eccentric bearing neck on the shaft is aligned with the longitudinal groove in the swivel lever hole and slide the eccentric shaft completely into the swivel lever.

Swivel the lever into the vertical position, and turn the eccentric so that the curve lever can be pushed through the governor hole and hooked into the recess in the eccentric shaft. The curve-lever hook must point downwards.

Caution:
Be sure that curve lever A-006 is installed (see VDT-I-PEU 002 B, page 5).

Swivel the swivel lever so that it rests against the curve lever.

Position the eccentric shaft with the off-center stop pin so that the ends of the tappets are located exactly in the center of the concave sections.


39

Slide the return spring over the guide bushing so that the longer end of the return spring on the lower side is positioned against the full-load stop on the bearing cap.

Slide the full-load lever onto the threaded neck of the eccentric shaft.

Hook the shorter end of the return spring into the nose of the full-load lever.

Slide the warm-up lever onto the threaded neck of the eccentric shaft.

Insert the guide disc, with the collar side first, over the eccentric shaft into the centering hole in the warm-up lever.

Screw the hexagon lock nut onto the threaded neck of the eccentric shaft and tighten it against the guide disc.

Assembling the pneumatic governor

Insert the ball support through the retaining ring from the flange side into the ball guide by tilting it.

Turn the ball support so that the two balls can be inserted into the hole provided.

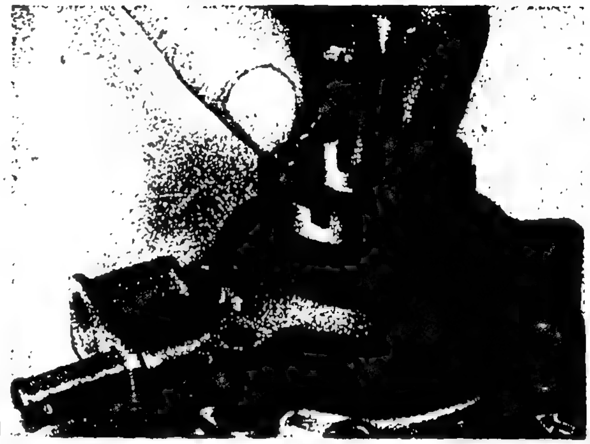
Now turn the ball support so that the surface of the ball guide and the surface of the ball support are parallel with each other.

40

Lay the small flexible diaphragm with the shoulder in the ring groove in the lower part of the housing.

Install the ball guide, with the ball support fitted, in the lower part of the housing so that the slotted side of the ball guide points toward the flattened side of the housing (arrow).

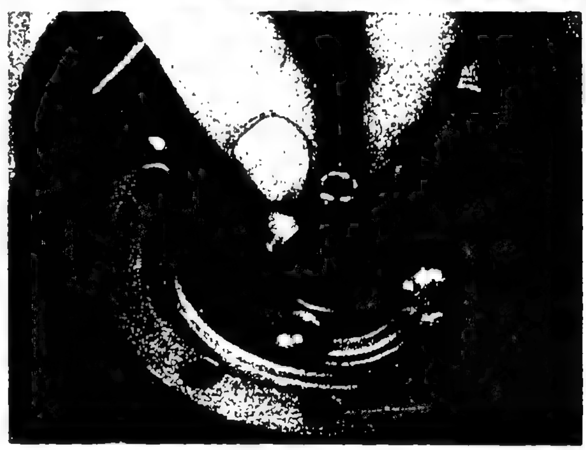
Secure the ball guide using the three fastening screws.



41

Place the centering bushing with its small diameter downward in the opening in the flexible diaphragm.

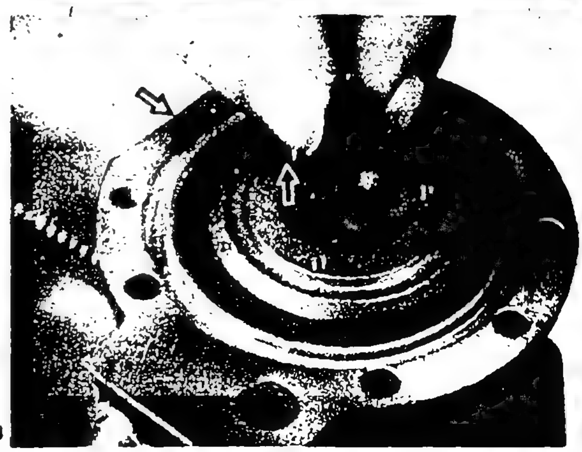
Press the centering bushing into the hole in the ball support.



42

Set the plunger on the centering bushing so that one of the three threaded holes points toward the flattened side in the lower part of the housing (see arrows).

Using the fastening screw, attach the plunger loosely to the ball support.



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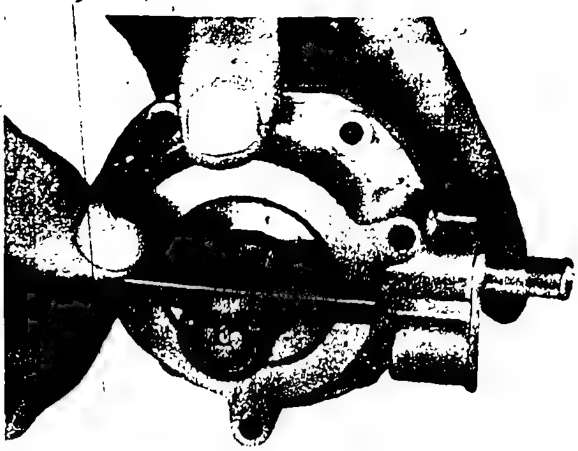


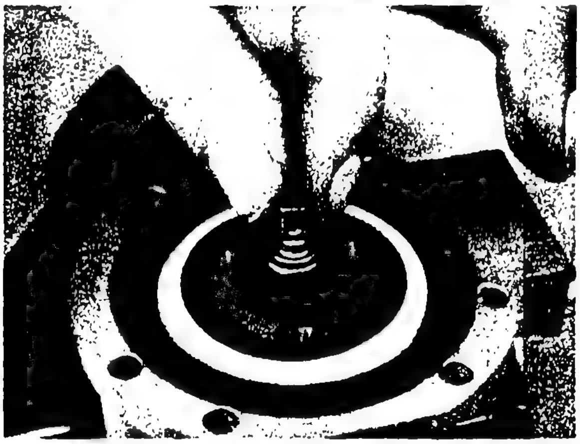
44

Using the positioning tool, position the ball support so that its longitudinal slot for the curve lever is in the center of the ball-guide slot. In this position, clamp the positioning tool with the ball guide in the vise. (The ball support must remain easily movable.)

Tighten the fastening screw in the plunger. In order to do this, hold the plunger stationary with the holding plate (fabricated by the user, see Section 12, Fig. 83).

45

When the positioning tool is removed, the flattened side of the ball support must run exactly parallel to the flattened side of the ball guide.



46

Lay the large flexible diaphragm with the small shoulder in the ring groove in the plunger.

Lay the support ring in the diaphragm.

Press the support ring together with the diaphragm over the plunger.

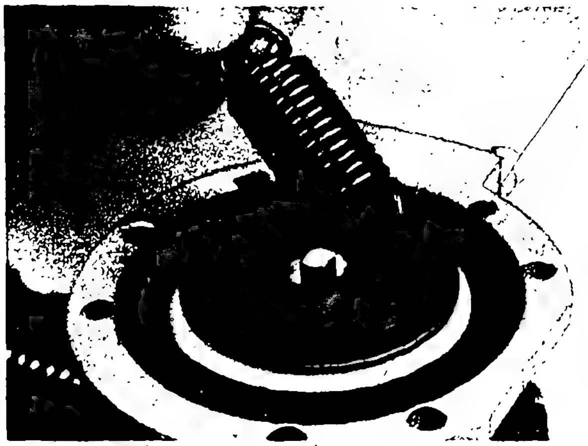
Insert the spring retainer with the mushroom-shaped head into the plunger.

Depending on the particular design, a washer can be present under the spring retainer. If a spring washer is installed, this washer must be replaced by a steel washer.

Lay the holding plate over the spring retainer and screw it firmly to the plunger using three new screws (sealed with lacquer).

Position the ball support using the positioning (fixing) piece (Section 12, Fig. 82). (The ball support must remain easily movable.)

Hook the helical extension spring into the spring retainer.

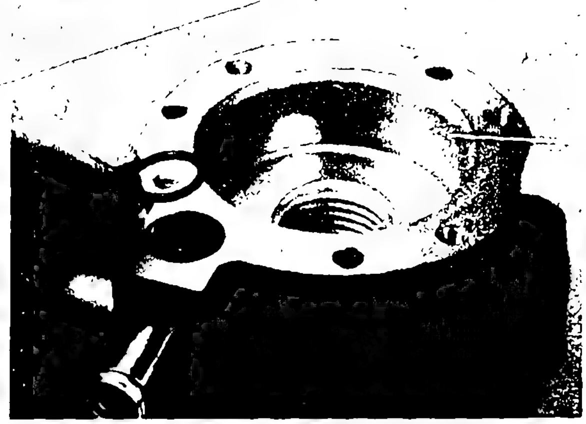


47

Place a loop-ring in the hole for the throttle plate in the upper part of the housing.

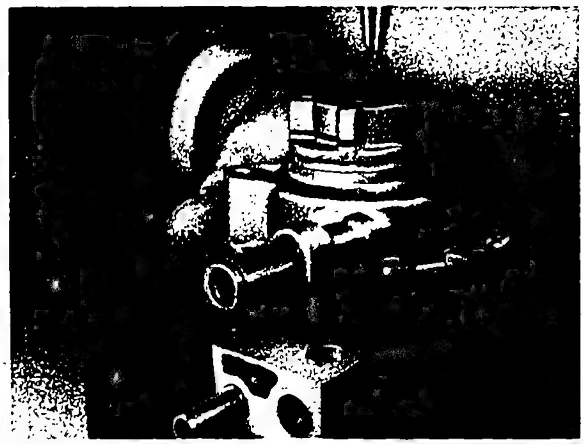
Lay the throttle plate on the loop-ring.

Lay the second loop-ring on the throttle plate.



48

Set the upper part of the housing over the helical extension spring and onto the flange side of the lower part of the housing. While doing this, the helical extension spring should be held vertical with pointed pliers. Be careful of the loop-rings and the throttle plate.

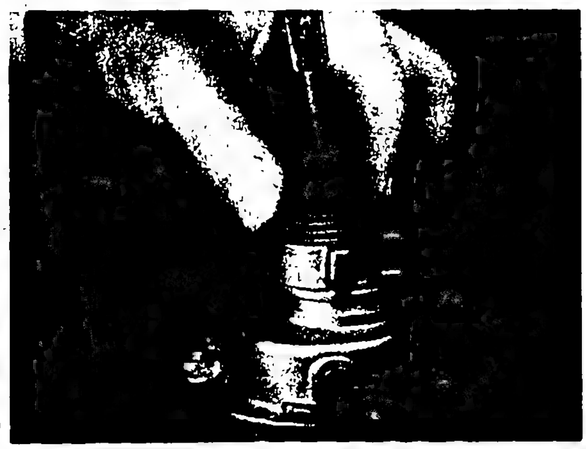


49

Join the two parts of the housing using the four fastening screws.

Screw the threaded bushing into the threaded hole in the governor housing.

Using pointed pliers, screw the helical extension spring into the threaded bushing by turning it counterclockwise.

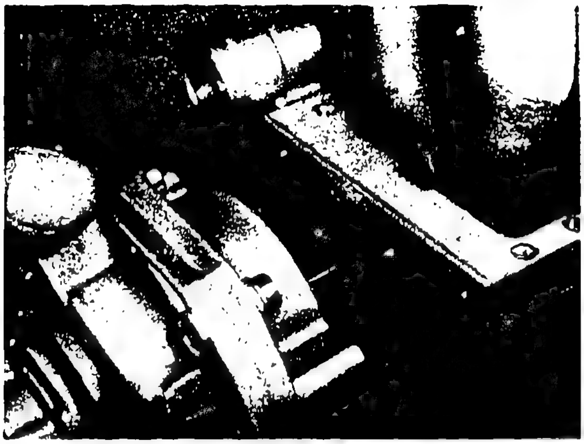


50

Place a loop-ring in the ring groove in the housing in order to seal the cap.

Test for leaks

Subject the vacuum chamber (opposite the spring side) to a vacuum of about 0.1 bar. The vacuum must not decrease during the next 30 seconds.

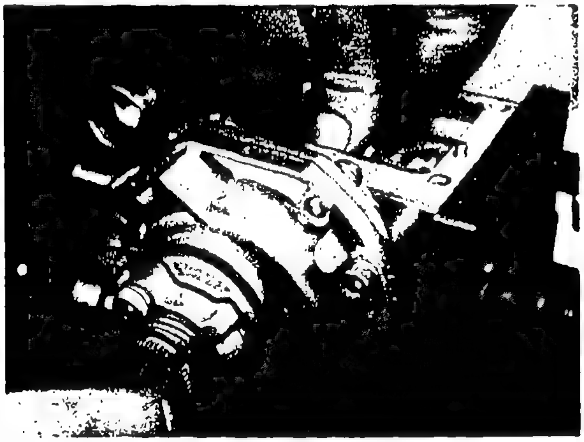


51

Slide the loop-ring onto the ball guide on the pneumatic governor.

Insert the guide piece of the pneumatic governor into the governor hole in the pump housing. While doing this lift the curve lever and lay it on the ball in the ball support.
Using the three fastening screws, firmly attach the pneumatic governor to the pump housing.

Caution:
The curve lever must be located in the center of the ball guide and must not scrape against it.



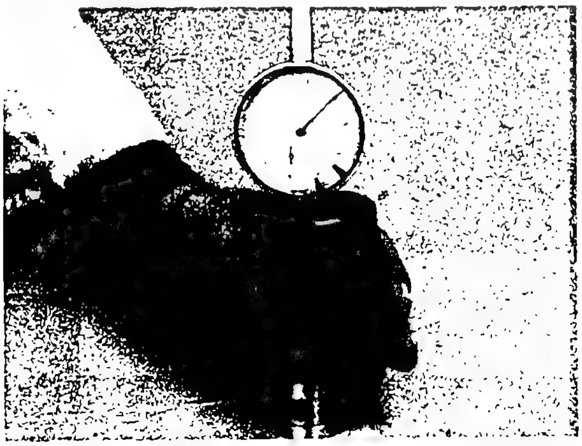
52

Basic setting of the governor spring

Turn the governor spring into the treaded bushing far enough so that the upper turn of the spring is level with the upper edge of the threaded bushing.
Unscrew the threaded bushing until the ball in the ball support is located at the full-load recess in the curve lever.
This point is reached when the swivel lever no longer springs back when it is pressed against the curve lever.

Lock the threaded bushing.

Place the spherical inserts in the swivel lever.



53

During the following measurement process special attention must be paid to cleanliness.

The spherical inserts must be dry.

Set dial-indicator gauge 92 921 002

Clamp dial indicator 1 687 233 012 in holder 92 921 003, and place it in adjustment piece 92 921 501. Prestress the dial indicator 10 mm and set it to "0".

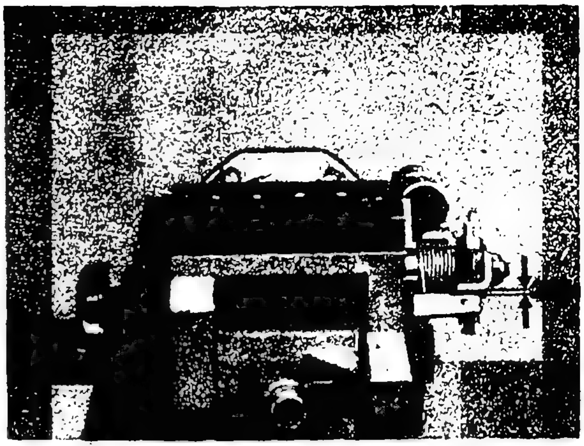
Slide the weight onto the dial-indicator holder and clamp it using the socket screw in the positioning hole.

Check the zero setting of the dial indicator with the adjustment piece.

Modify guide plate 92 921 005 according to Fig. 84 in Section 12, and place it on the pump housing.

Set the adjusting screw so that there is a space of 2 mm between the drag lever and the housing.

Mount drive coupling 1 686 430 011.



54

In order to match the strokes, mount the dial-indicator gauge.

Turn the camshaft through a complete rotation.
If there is a difference between the strokes of the individual plungers of more than ±0.065 mm, the stroke should be matched by replacing the spherical inserts or by lapping the plane face of the camshaft lobe.

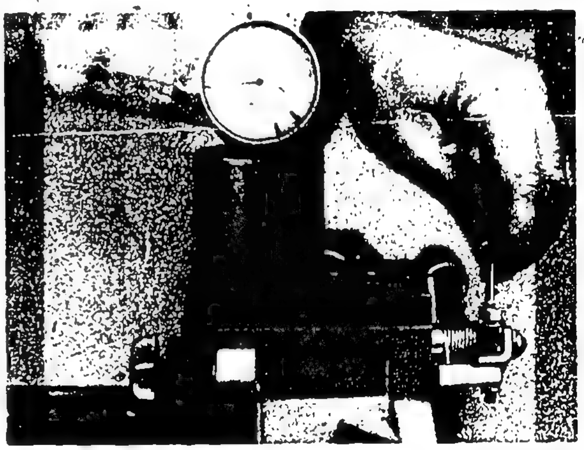
Caution:
The measurement equipment must be set up exactly vertically.

Clean the spherical insert thoroughly and place it in the swivel lever. Measure the effective stroke again.

When all plungers have been matched, the locking washers are placed on the spherical inserts.

Press the retaining ring into the ring groove in the swivel lever.

Set the specified effective stroke at the full-load adjusting screw according to the test-specification sheet.



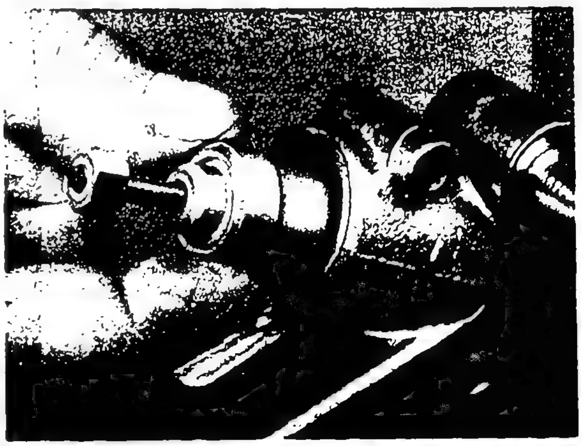
55

Assembling the warm-up sensor

Clamp the warm-up sensor in the vise and slide the expansion element into the housing so that the pressure pin points upward.

Place the loop-ring on the expansion element in the housing.

Lay the thrust washer on the loop-ring.



56


57

Slide the pressure sleeve, with the turned-down end upward, into the housing.

Slide the spring seat and the helical compression spring onto the tie rod.

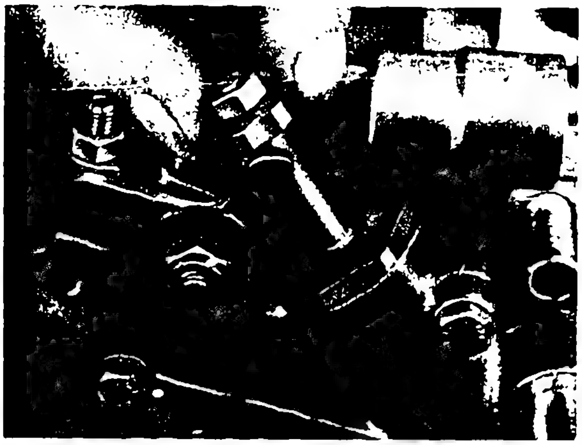
Insert the tie rod together with the spring seat and helical compression spring into the housing.

Slide the threaded sleeve over the tie rod onto the helical compression spring and then, while pressing on it strongly, screw it into the housing and tighten it in place.

Screw the control cone and the lock nut onto the tie rod.

Test for leaks

Close one of the two water connections. Build up a pressure of 1.5 bar (overpressure) in the immersion bath. The water chamber must have no leaks.

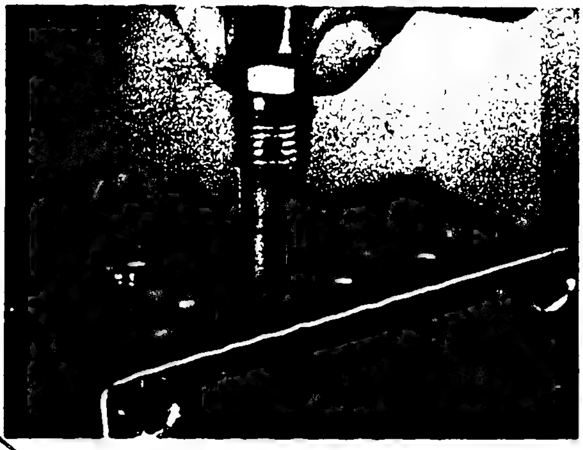

58

Mount the warm-up sensor on the pump housing; before doing so, fit the loop-ring to the fitting covered by the sensor.

Slide the control cone behind the warm-up lever and press the warm-up sensor onto the positioning pins on the pump housing.

Screw the warm-up sensor to the pump housing with the three long fastening screws.

Set the control cone so that it does not touch the warm-up lever.


59

Assembling the pump head

Clamp the pump head to clamping plate 92 920 010.

During the working steps described below special attention must be paid to cleanliness!

Place a new loop-ring on the suction valve using the assembly sleeve (to be fabricated by the user – see Section 12, Fig. 85).

Place a mesh filter over the suction valve.

Insert the suction valve in the threaded hole after coating the loop-ring lightly with oil or grease.

Tighten the suction valve in place – be careful of the loop-ring.

Insert the delivery-valve assembly into the threaded hole in the pump head so that the guide pin fits into the slot in the valve.

Place the thrust washer on the delivery-valve assembly.

Slide the threaded ring over the delivery-valve assembly and tighten it with wrench 92 922 100.

Press the concial spring into the hole provided for it so that the plastic "mushroom" points upward.

Insert the bushing with the plunger into the hole in the pump head.

60

Insert the first loop-ring over the bushing into the hole in the pump head and slide it in using the locally fabricated sleeve (see Section 12, Fig. 85).

61

Place the pressure sleeve on the loop-ring.

Place the second loop-ring on the pressure sleeve.

Lay the thrust ring in with the recessed side facing the loop-ring.

Tighten the plunger bushing with the threaded ring. Use wrench 92 924 100.

62

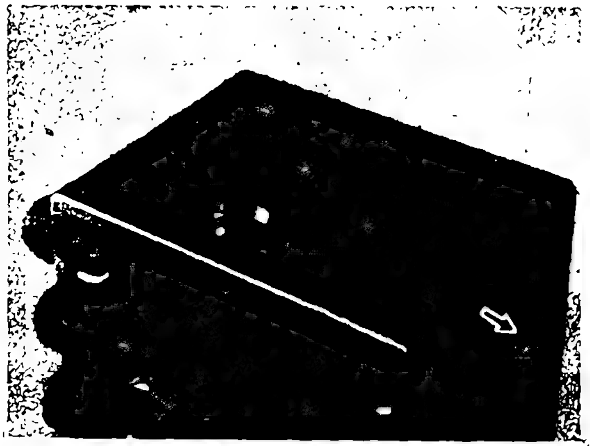
Pull the plunger out of the bushing and place the plunger return spring over the bushing.

Slide the spring seat onto the plunger, and insert the plunger together with the spring seat into the associated plunger bushing.

Caution:
The plungers must not be interchanged!

Screw the oil-level control plug into the threaded hole.

63


64

Mount clamping plate 92 920 010 on the pump head so that the pump plungers are supported on the clamping plate.

Test for leaks at the oil-block chamber

Apply a pressure of 5 bar (5 kgf/cm²) overpressure at the oil-block connection (arrow) using nozzle tester 0 684 200 700 and pressure gauge 1 687 231 007. The pressure must not fall below 4 bar during the next 30 seconds.

Test for leaks at the suction and plunger chamber

Close the return hole leading from the suction chamber (gallery) and the hole for the engine oil connection.

Apply an air pressure of 3.0 bar (overpressure) to the suction chamber and test for leaks in the oil bath.

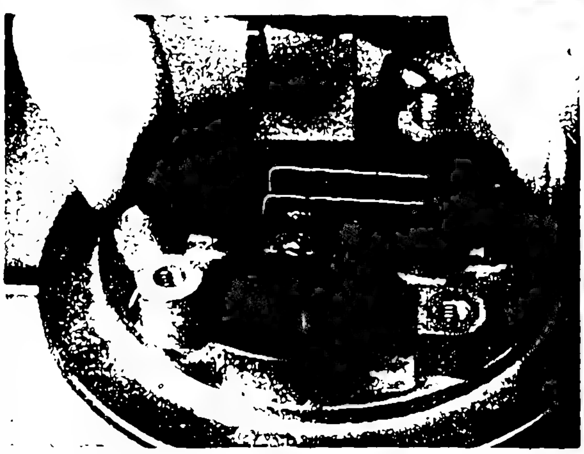
The suction chamber must be absolutely free of leaks.

Slight leaks at the pump plunger are permissible.


65

6. Assembling the altitude governor

Place the aperture plate on the base plate so that the contours of the aperture and base plates coincide.

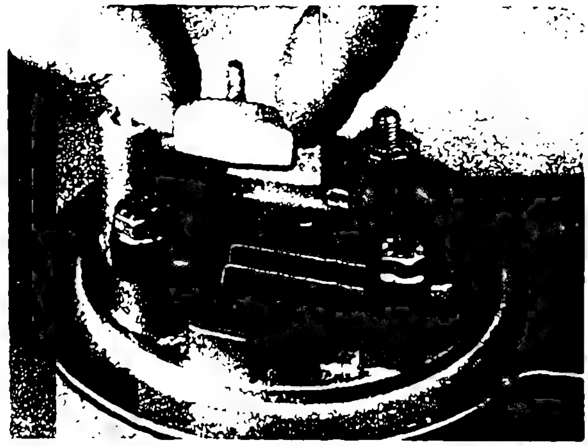

66

Set the guide piece on the base plate so that the two pins on the narrow section of the guide piece fit into the holes in the aperture plate and base plate

Center the guide piece with the two fastening screws on the base plate.

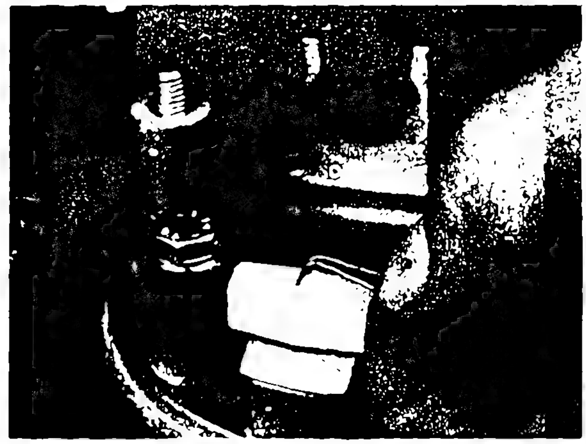
The two pins on the slider must fit into the positioning holes in the slider plate.

Place the slider with the slider plate on the aperture plate; while doing this, be careful that the contours of the slider and slider plates remain matched.



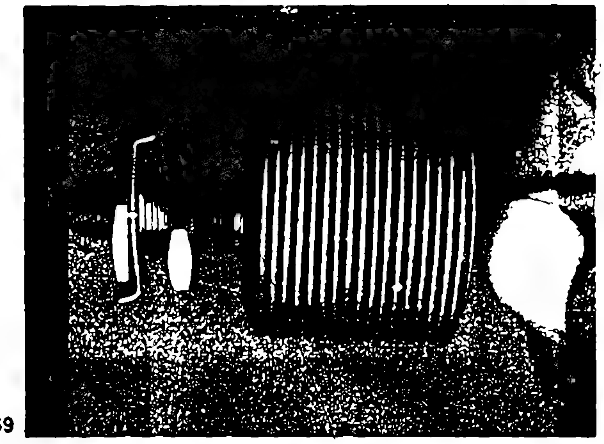
67

Insert the two bent ends of the hook springs into the holes in the slider. The slider and slider plate must be pressed lightly against the aperture plate by the springs.



68

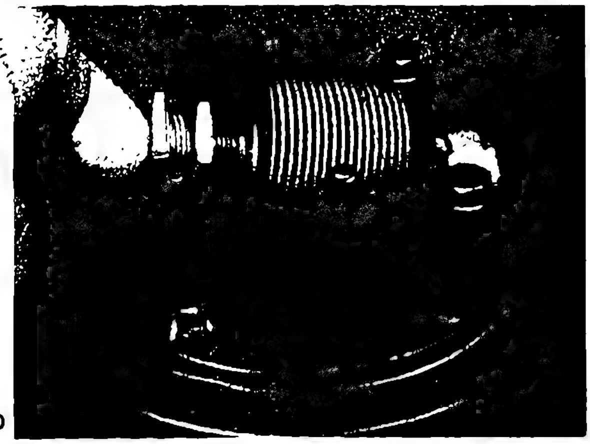
Assemble the barometer capsule, adjustment nut, tab washer and lock nut as shown in Fig. 69.



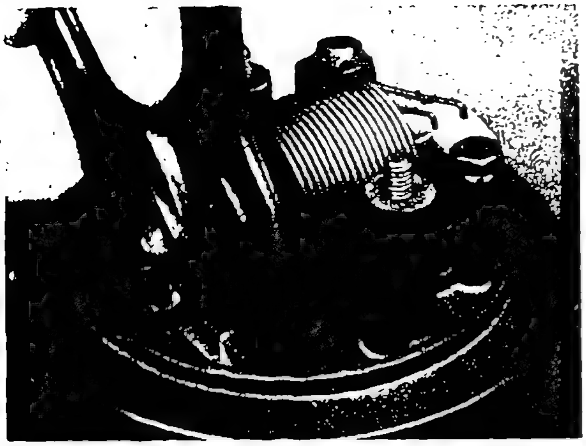
69

Insert the pressure pin on the barometer capsule into the hole in the guide piece.

Slip the adjustment nut into the retaining fork from above.



70

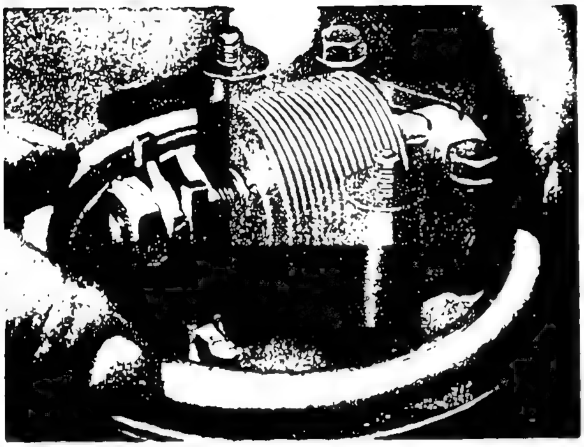


71

Using the lock nut, tighten the adjustment nut against the retaining fork.

The tab washer is positioned here as shown in Fig. 72.

Screw the hexagon nut onto the threaded shaft of the barometer bellows and tighten against the adjustment nut.



72

Place a washer over each of the two stud bolts on the base plate.
Lay the loop-ring (for sealing the cover) on the base plate.

Tighten the fastening screws holding the guide piece.

The new altitude governor 8 492 610 000 is adjusted similarly.

Differences from the old design:

- 1 threaded clamping jaw to position the barometer bellows,
- new slider piece with wire bracket,
- 2 helical extension springs.

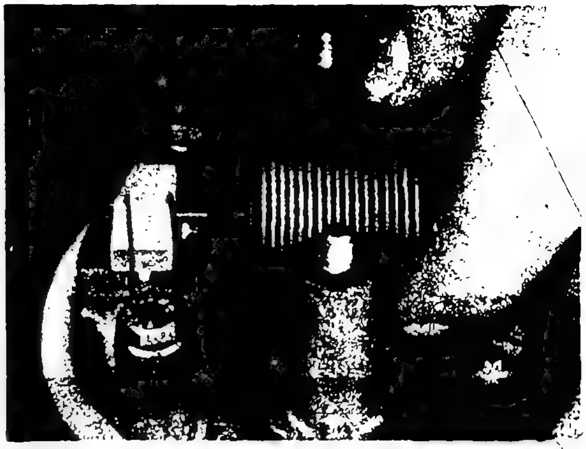
Be sure that the plastic driver which is slid onto the barometer bellows pin is fitted so that it can move together with the metal clamp without play.

7. Adjusting the altitude governor

Determine the exact barometric pressure (check with the weather bureau or use a mercury barometer).

The slider must always be positioned against the pressure pin extending from the barometer bellows, forming a positive connection.

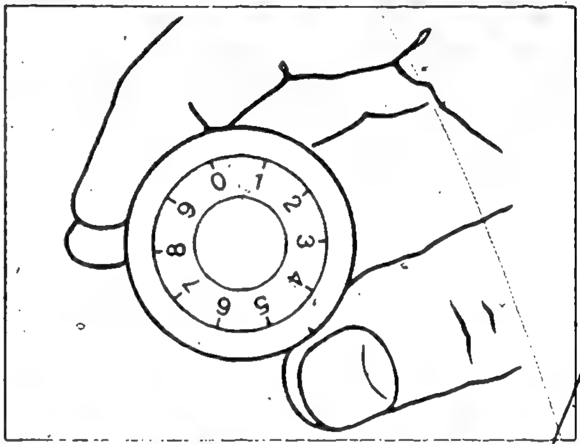
Release the lock nut on the barometer bellows, and by turning the bellows move the slider in the "Close" direction until the slot in the aperture plate is just covered. While doing this, tap lightly on the housing. This is the 0 position.



73

On the end of the barometer are dividing marks arranged radially and numbered from 1 to 10. Turning the barometer bellows by one division means a change of 1/10 mm in the slot opening.

Starting from the 0 position set as described above, turn the barometer bellows clockwise until the desired slot opening is set.
Lock the barometer bellows in this position with the lock nut.



74

Place the cover over the two stud bolts on the altitude governor. Be careful of the O-ring!

Screw the two slotted round nuts onto the stud bolts.

75

8. Adjusting the governor

(Test-specification sheet, Section A)

Mount the injection pump on the test bench using clamping flange 1 685 720 193 so that the governor points vertically upward.

Mount the alignment pump-head 1 688 130 141 with plungers, plunger return springs, and conical helical spring (**without seal!**) on the injection-pump housing.

Screw measurement device KDEP 2940, with dial indicator 1 687 233 012, into the threaded hole in the alignment pump-head.

With the pump plunger in the TDC position, prestress the dial indicator 10 mm and set it to "0".

Check the "Full load" effective stroke according to the test-specification sheet, and correct it at the full-load stop screw if necessary.

Mount the test cap, with pressure hose, on the governor.

Connect the compressed-air system and pressure gauge 1 687 232 038 according to the connection diagram (Fig. 76). Fit the restriction to the governor, see Fig. 76 (warm-up regulator housing connection).

Set the scale on the pressure gauge to "0" with the knurled thumb screw.

Determine the exact barometric pressure in mbar (for example from the weather bureau or by means of a mercury barometer – in mbar)!

Set the effective stroke for "Part load 2"

Determine the adjustment pressure according to the prevailing atmospheric pressure from "Graph 3" in the test-specification sheet.
Set this pressure on the pressure gauge.

Drive the injection pump at about 25 rev/min.

The effective stroke according to the test-specification sheet must be attained. Any correction necessary is made by turning the threaded bushing and the governor spring together; to do this, first remove the test cap.

Turning in the clockwise direction results in decreasing the stroke, while turning in the counter-clockwise direction results in increasing the stroke.

Set the effective stroke for "Overrun" and "Fuel cutoff during overrun"

Determine the adjustment pressure according to the prevailing atmospheric pressure from "Graph 4" for "Overrun" and "Fuel cutoff during overrun" in the test-specification sheet, and set this pressure on the pressure gauge.

Drive the injection pump at about 25 rev/min.

Check the effective stroke according to the test-specification sheet.

Any correction necessary is made by turning the threaded bushing – in this case the governor spring is not turned.

Turning in the clockwise direction results in increasing the stroke, while turning in the counterclockwise direction results in decreasing the stroke.
If a correction has been carried out here, the measurement of "Part load 2" must be checked.

Carry out the two adjustments alternately until both measuring points are attained according to the test-specification sheet.

After every test secure the governor spring against being turned by replacing the safety cap.

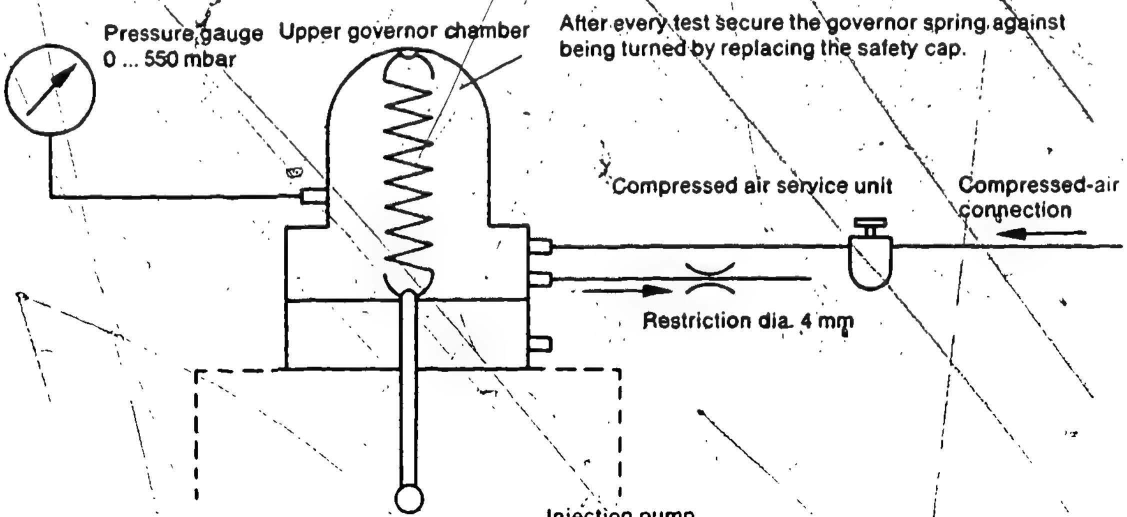
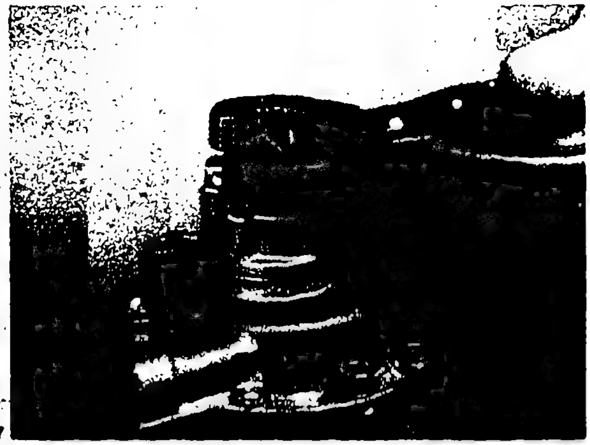


Fig. 76 Connection diagram

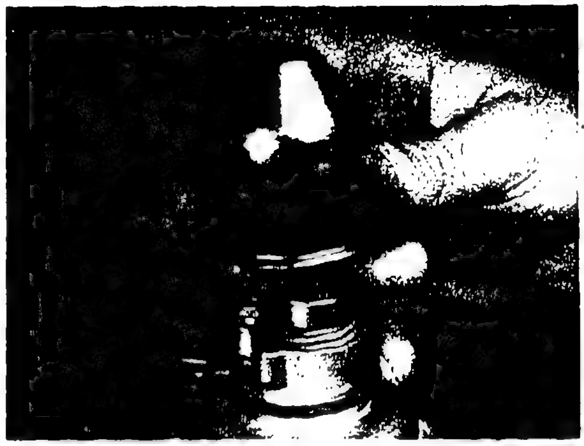
Secure the governor bushing and governor spring against turning.
Check the measuring points again.

Remove the test cap.



77

Screw the cap tightly onto the governor housing. Be careful of the O-ring.



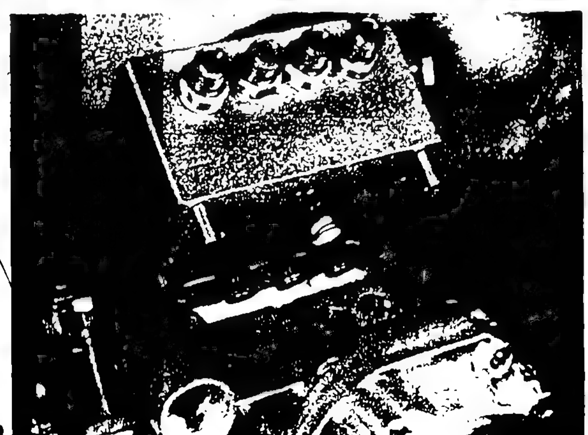
78

Remove the alignment pump-head from the pump housing. Place the pump head seal on the housing.

79

Tilt the pump head and set it from the side on the pump housing.
Be sure that the plungers do not fall out of the bushings.

Press the pump head onto the housing against the plunger-return springs, and screw it to the housing with the 4 fastening screws.



80

9. Adjusting the injection pump with governor

(Test-specification sheet, Section B)

Clamp the injection pump onto the test bench. Connect the fuel-injection tubing as well as the fuel feed and return lines at the pump head.

Remove the oil-level control plug.

Fill the injection pump with engine oil SAE 20 until it flows out from the oil-level control hole without bubbles.

Replace the oil-level control screw together with a sealing washer.

Caution:
As a basic rule, during the fuel delivery measurement the warm-up lever and the full-load adjusting screw must be positioned against the stop.

Place the test cap on the governor and secure it against being lifted off.

Set the feed pressure according to the test-specification sheet.

At the speeds and pressures specified according to the graph, measure the fuel delivery.

Caution:
During the fuel delivery measurement monitor the pressure on the pressure gauge!

Screw the cap onto the governor housing.
Be careful of the O-ring (Fig. 78).

Remove the injection pump and pour out the engine oil.

Apply a pressure of 0.5 bar overpressure (0.5 kgf/cm^2) to the injection pump in the oil bath; in order to do this, connect the air pressure feed line to the oil drainage hole, and seal the oil filling opening.

10. Adjusting the warm-up sensor

Wash the water chamber in the warm-up sensor out with water warmed up to 45° C; for this purpose use control thermometer 92 920 522.

Adjust the plate nut on the air slider at the threaded pin so that the body of the drag lever is touched (arrow, Fig. 81).

Secure the plate nut with a lock nut.

Seal the injection pump and governor.

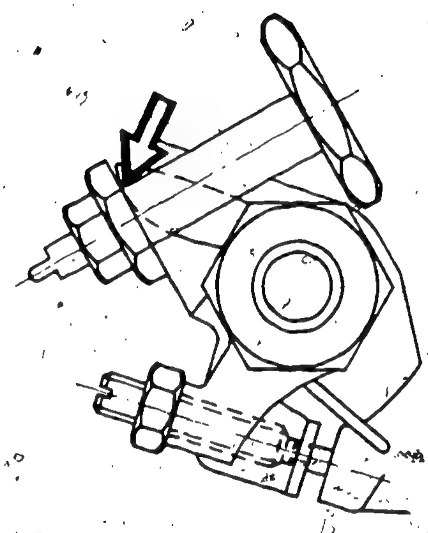


Fig. 81

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11. Tightening Torques

	Nm	kgf.m
Suction valves	25 ... 30	2.5 ... 3.0
Threaded rings for delivery-valve assemblies	45 ... 50	4.5 ... 5.0
Hose fittings	15 ... 20	1.5 ... 2.0
Threaded rings for plunger bushings	35 ... 40	3.5 ... 4.0
Fastening screws for cover	9 ... 11	0.9 ... 1.1
Threaded ring for sliding tappet	18 ... 20	1.8 ... 2.0
Fastening screws for pneumatic governor	9 ... 11	0.9 ... 1.1
Fastening screws for warm-up sensor	9 ... 11	0.9 ... 1.1
Fastening screws for pump head	9 ... 11	0.9 ... 1.1

12. Auxiliary Tools

Fig. 82

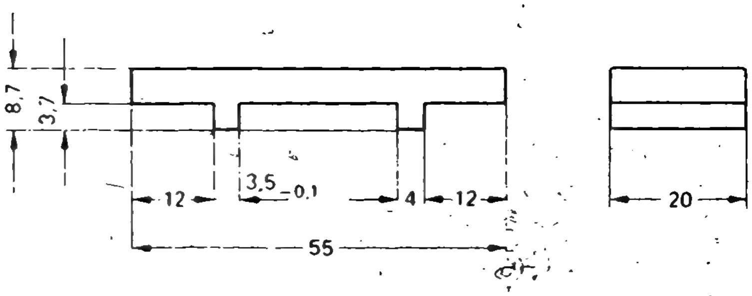


Fig. 83 Holding plate

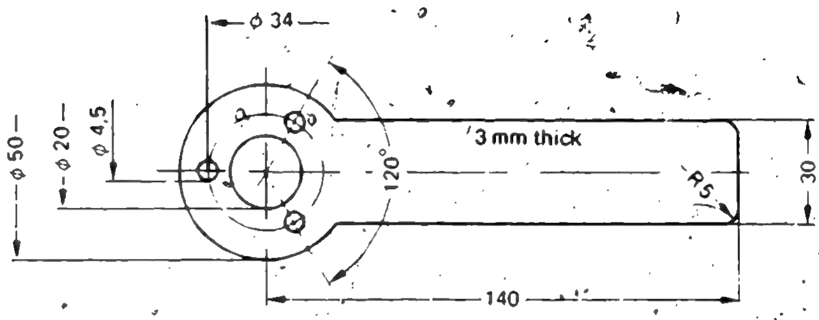


Fig. 84

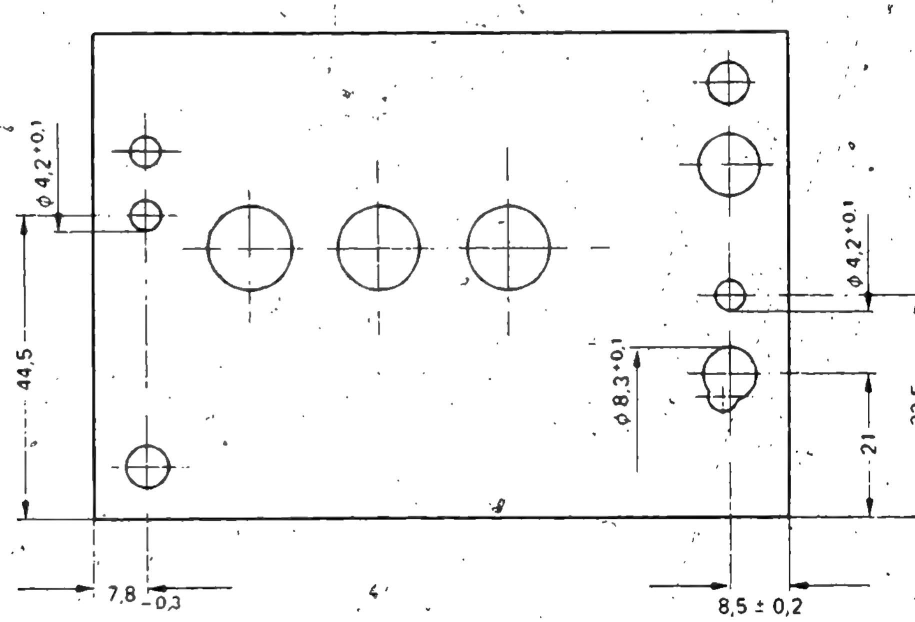


Fig 85

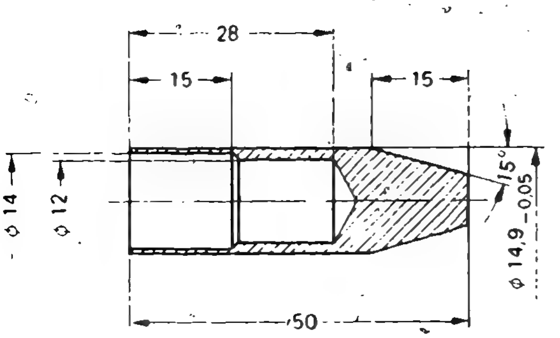
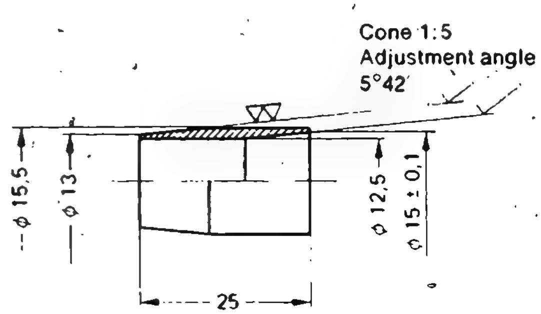


Fig. 86 Assembly sleeve



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Kenntnis genommen:	Bearbeiter	Inhaber	Meister	Mechaniker
Noted by:	Project Specialist	Owner	Supervisor	Mechanic

Hanomag vehicles with EP/VA..
distributor-type injection pump
Trouble-shooting notes

VDT-BMP 161/24 B EP 46
Edition 11.70
Translation of German edition of 22.9.70

To our foreign representatives

This Technical Information Sheet gives some trouble-shooting notes for Hanomag vehicles with EP/VA.. distributor-type injection pumps. Only possible faults connected with the injection system are mentioned. Faults in the electrical system or in the engine are assumed to be known and are therefore not taken into account here.

Symptom	Fault	Remedy
I. Engine will not start	1. Lack of fuel	
	1.1 Tank empty	Fill with fuel
	1.2 Air in the fuel circuit	Vent in accordance with BMP 161/19 dated 19.10.1967 point 7
	1.3 Priming pump (not of Bosch manufacture) defective	
	1.3.1 Strainer clogged	Clean strainer screw
	1.3.2 Suction valve broken	Replace upper section of pump
	1.3.3 Delivery valve worn	Replace upper section of pump
	1.4 Fuel filter clogged	Replace filter box; where fitted, clean primary filter Note: Use only original filter boxes (see also BMP 161/18 dated 19.12.1969)
	1.5 Lines blocked	Clean lines, remove constrictions
	1.6 Paraffin wax deposits at temperatures below freezing point resulting from unsuitable fuel	Proceed in accordance with BMP 161/23 dated 18.9.1968
	1.7 Distributor-type pump (DP) defective	
	1.7.1 Drive and supply pump are binding	Repair DP or replace entire DP
	1.7.2 Pump plungers are binding	Repair DP by replacing the distributor head or replace entire DP

Symptom	Fault		Remedy
	1.7.3	No starting quantity	Check DP. Free starting piston or replace helical spring (see also BMP 161/26 dated 11.12.1968)
	1.7.3.1	Pumps with automatic starting quantity: Starting piston in the distributor head is sticking or helical spring is broken	
		Pump plungers are worn	Repair DP by replacing the distributor head or replace the entire DP
	1.7.3.2	Pumps with mechanical starting quantity: Pump plungers are worn	Repair DP by replacing the distributor head or replace entire DP
	2.	Incorrect injection point	
	2.1	Basic port-closure setting incorrect	Adjust to prescribed value (BMP 161/19 dated 19.10.1967)
	2.2	Timing device is sticking	Repair DP
II. Low idle, irregular, speed too high, cannot be adjusted		Check valve in distributor head leaks (caused by dirt on the seat)	Try to dislodge dirt from seat by repeatedly accelerating jerkily at a standstill. If this gives no improvement, repair DP see BMP 161/31 B and 1st. 1st. supplement
III. Engine hunts during idling	1.	Overflow valve on DP is sticking	Replace overflow valve
	2.	Supply pump pressure too low (timing device or pressure equalizer piston worn)	Check DP; adjust supply pump pressure to prescribed value or replace DP if worn
IV. Engine has no power	1.	Lack of fuel	
	1.1	Fault in circuit	see under I
	1.2	Full-load quantity of DP too small	Check DP and adjust full-load quantity to prescribed value
	2.	Port-closure adjustment ring incorrectly set (too far retarded)	Adjust port-closure to prescribed value (see BMP 161/19 dated 19.10.1967)
	3.	Timing device is sticking in retard position	Repair DP
	4.	Injection nozzles defective	Check nozzles, correct opening pressure, replace damaged nozzles

Symptom		Fault	Remedy
V.	Engine emits very black smoke in full-load range	Full-load quantity of DP too great	Check DP and adjust full-load quantity to prescribed value.
VI.	Engine has no power and emits very black smoke	1. Incorrect pump setting	
		1.1 Port-closure adjustment ring incorrectly set (too far retarded)	Adjust port-closure to prescribed value (see BMP 161/19 dated 19.10.1967)
		1.2 Delivery quantity settings of the DP incorrect (too high)	Check DP and adjust the delivery quantities to the prescribed values
		2. Timing device is sticking in retard position	Repair DP
		3. Injection valves defective	Check nozzles, correct opening pressure, replace damaged nozzles
VII.	Engine afterfires	Stop position of the spill piston (delivery rate control lever) is set too early	Correct setting
VIII.	Engine runs hard, emits very black smoke in the full-load range, possibly with loss of power	1. Port-closure setting too advanced	Adjust port-closure to prescribed value (see BMP 161/19 dated 19.10.1967)
		2. Timing device is sticking in advance position	Repair DP
		3. Injection nozzles defective	Check nozzles, correct opening pressure, replace damaged nozzles
IX.	DP leaks	1. Pipe connections leak	Check pipe connections for cavitation. Fit new gaskets and/or pipe connections
		2. O-ring seal is damaged	Fit new O-rings

Kenntnis genommen:	Bearbeiter	Inhaber	Meister	Mechaniker
Noted by:	Project Specialist	Owner	Supervisor	Mechanic

EP/VA..
Defects in the ball check-valve in the distributor head

VDT - BMP 161 / 31 B
Edition 2.70
Translation of German edition of 8.4.1969

EP
0 46

To VH, AV/S, BD, BV

Our technical information sheet BMP 161/24 dated 18.12.68 gives trouble-shooting instructions for Hanomag vehicles fitted with EP/VA.. injection pumps. Naturally, these instructions can always be used for other makes of tractors fitted with EP/VA.. injection pumps.

It has been found that the following defect often occurs:

Point II - Lower idle irregular,
speed too high, not adjustable

The cause is bad sealing of the check valve in the distributor head. This valve is a ball check-valve which may seal badly due to dirt on the valve seat.

If a vehicle or tractor is brought into your workshop with the above fault, first check, as mentioned in technical information sheet BMP 161/24, whether the dirt can be removed from the valve seat by sudden acceleration of the engine.

If this is not successful, the injection pump must be removed.

If the cause is dirt on the ball or on the valve seat, which has not damaged the seat, one can proceed as follows.

1. Dismantle distributor head without removing the delivery valve connections and delivery valves.
2. Provisional testing for check valve leaks

   Insert the compressed air pistol in the spill piston port and apply pressure. If air comes out of the auxiliary circuit port of the ball check-valve, the valve is leaking.
3. Elimination of the leak

   Lift the ball with a suitable hook and blow out the dirt from the ball valve.
4. Refitting the distributor head and checking according to test sheet

   If the prescribed test values are not obtained, particularly in the idle range, the valve seat must be reground.

A supplement to this technical information sheet, dealing with this repair work, is being prepared; copies will be sent to you as soon as they become available.

In this connection we ask you to keep good contact with your repair shop so that faults may be immediately recognised and eliminated.

The decision whether you should carry out this repair depends largely on how long the tractor or the injection pump was in operation with this defect and whether the valve seat has not yet been damaged.

KH/VKG 2

After-sales Service

Technical Bulletin

46

VDT-I-460/100 B

4. 1976

0 460 .. - EP/VA ..H..C..
Distributor-type fuel-injection pump with quiet-idle device

Quiet-idle device leakage test.

The quiet-idle device leakage test can be carried out either in the vehicle or on the test bench.

1. Leakage test in the vehicle

1.1 The linkage between the quiet-idle device and the operating lever must be disconnected.
Note: The quiet-idle device lever must not be removed.

1.2 Remove the hose from the quiet-idle device.

1.3 Push a transparent hose onto the quiet-idle device fitting for the purpose of measuring the leakage fuel.

1.4 Position the quiet-idle device lever exactly vertically, pointing upwards towards the return fitting (see fig. 1). The quiet-idle device has thus been put out of action.

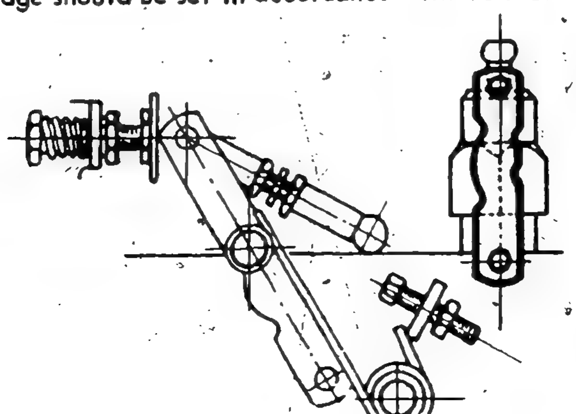
1.5 Set the engine to idle speed.

1.6 Measure the overflow quantity with a suitable measuring glass. In so doing ensure that the fuel flows uniformly out of the hose during the measurement.

1.7 Test value:
Permissible leakage quantity = max. 6 cm^3 during measurement time of 3 mins.

1.8 If the permitted value is exeeded, the quiet-idle device must be replaced.
Tightening torque for central screw plug: 40 - 60 N.m (4 - 6 kgf.m).

1.9 The linkage should be set in accordance with VDT-BMP 161/36 B.



BOSCH Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
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RE-USING DELIVERY-VALVE HOLDERS

VDT-I-460/132 En

MODIFIED TORQUE ON DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS VE.. and VA..

2.1984
Supersedes Ed. 10.1983

Removed (deformed) delivery-valve holders may only be re-used under the following conditions:

* the sealing edge is not damaged or cracked;
* the sharp edge on the shaped seal is only deformed slightly and is without visible shoulder;
* the valve holder is not seized in the delivery-valve holder.

When exchange-scheme fuel-injection pumps are repaired, delivery-valve holders which are rusty on the outside or which are damaged must at all costs be replaced.

* The tightening torque of used delivery-valve holders is

  38...42 Nm

* The tightening torque of new delivery-valve holders when these are screwed into a new distributor head is

  38...48 Nm

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH
Geschäftsbereich KH Kundendienst. Kfz-Ausrüstung.

BOSCH

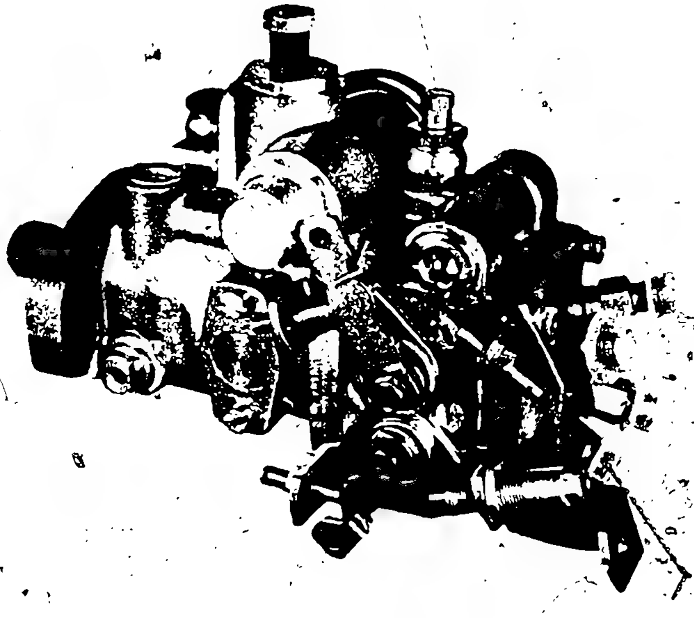
REPAIR INSTRUCTIONS
INSTRUCTIONS DE RÉPARATION
INSTRUCCIONES DE REPARACION

EP

VDT-WJP 161/3 B

Edition 11.69 + Suppl. 1 + 2

Distributor-type Fuel Injection Pump
Pompe distributrice
Bomba distribuidora de inyección
EP/VA ..H..A.. 0 460 ..



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par maison Georg Knoblauch, Stuttgart

ROBERT BOSCH GMBH STUTTGART GERMANY

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WJP 16113

1. TOOLS OUTILLAGE HERRAMIENTAS

Tool Outil Herramienta	Part No. Référence No. de pedido	Type designation Symbole Fórmula de tipo	Use Utilisation pour Aplicación
Swivel vise Support de fixation Soporte de sujeción	0 681 240 048 +	EF 8498	For clamping pump Fixation de la pompe Sujeción de la bomba
Clamping bracket Support Soporte	1 688 120 034 +	EFEP 432	For clamping pump Fixation de la pompe Sujeción de la bomba
Extractor hook Crochet d'extraction Gancho de extracción	1 687 959 010	EFEP 467	For removing seals Enlèvement des joints Quitar los anillos de junta
Seal protecting sleeve Douille de montage Manguito de montaje	1 680 300 040 +	EFEP 442	For protecting oil seal Protection de l'anneau d'étanchéité Protección del anillo de retención
Stop plate Plaque de butée Placa de tope	1 680 022 002	EFEP 502	For setting travel of timing piston Réglage de la course du piston de l'avance à l'injection Ajuste de la carrera del émbolo del variador de avance
Gauge ring Bague de mesure Anillo de medición	1 683 458 007	EFSR 3Y 13X	For setting timing piston travel and compressed spring length adjustment Réglage de la course du piston de l'avance automatique et de la longueur de montage du ressort Ajuste de la carrera del émbolo del variador de avance y del largo de montaje del resorte
Measuring device Dispositif de mesure Dispositivo de medición	1 688 130 045	EFEP 462	For plunger lift to port closure adjustment Réglage de la précourse Ajuste de la carrera improductiva
Measuring device (two parts) Dispositif de mesure (en deux parties) Dispositivo de medición (en dos piezas)	1 688 130 047	EFEP 468	For determining governor spring Evaluation du ressort de régulation Determinar el resorte de regulación
Assembling sleeve Douille de montage Manguito de montaje	1 680 390 000	EFEP 461	For protecting the O-ring Protection du joint torique Protección del anillo O
Spacer bushing Douille calibre de distance Casquillo de distancia	1 680 300 039	EFMB 21 Y 5 X	For setting piston spring preload Réglage de la tension initiale du ressort de piston Ajuste de la tensión previa del resorte del émbolo

+) Already in use for EP/VM..
Est déjà utilisé pour EP/VM..
Se emplea ya con EP/VM..

Complete set of above tools: (swivel vise 0 681 240 048 not included) Jeu complet de l'outillage ci-dessus: (sans support de fixation 0 681 240 048) Juego completo de las herramientas anteriores: (sin el soporte de sujeción 0 681 240 048)	1 687 000 012	EFEP 522
Tools set supplementing EP/VM.. tools Jeu d'outillage complémentaire à l'outillage des pompes EP/VM.. Juego complementario de las herramientas de EP/VM..	1 687 000 014	EFEP 524

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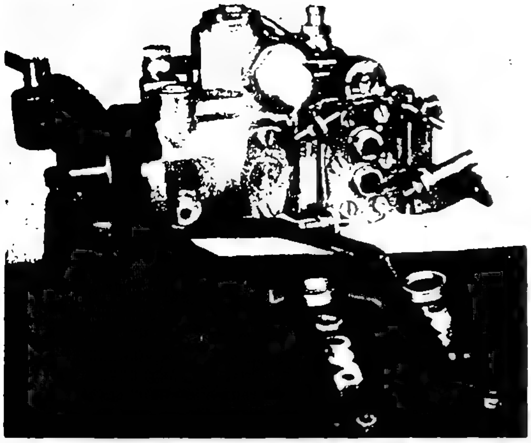
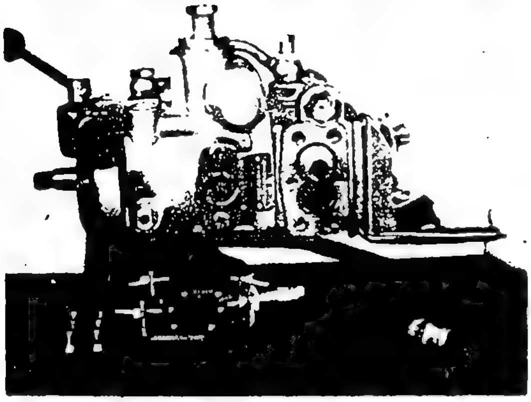
2. Disassembly



Remove coupling Mount injection pump in swivel vise 0 681 240 048 using clamping bracket 1 688 120 034. Remove hex nuts with spring washers, speed control lever, stop lever, washer under stop lever and torsion springs.

Fig. 1

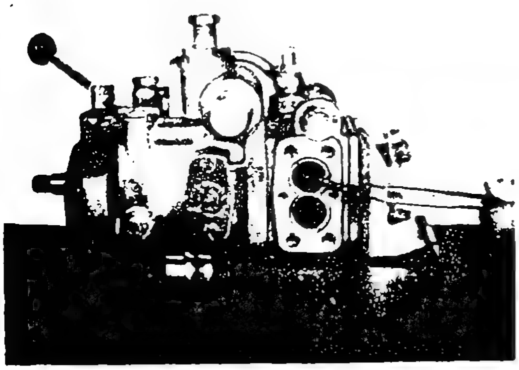


Unscrew flat-head screws and remove stop plate.
Remove spill piston governing assembly with governor spring.
Withdraw spill piston.

Fig. 2

Take apart spill piston governing assembly. For this purpose, place threaded end onto work bench and push out bushing downwards. Remove O-rings from shaft and bushing.

Fig. 3



Remove throttle with helical spring and cross-type disc.

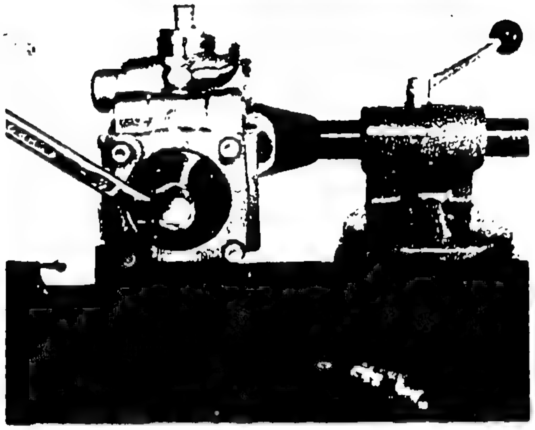
Attention:

Do not drop or lose spacer. This spacer is matched in production to the distributor head and cannot be replaced.

Fig. 4

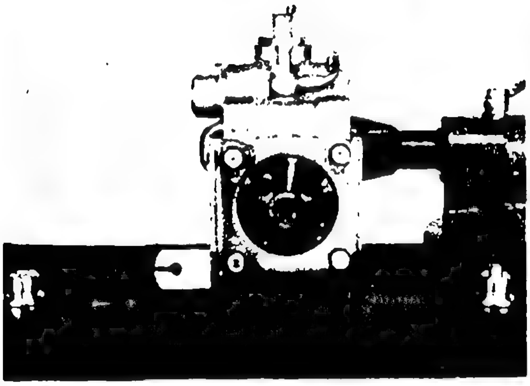
Disassemble throttle bushing assembly by placing threaded end on work bench and pressing out bushing downwards. Remove O-rings from shaft and bushing.

Fig. 5



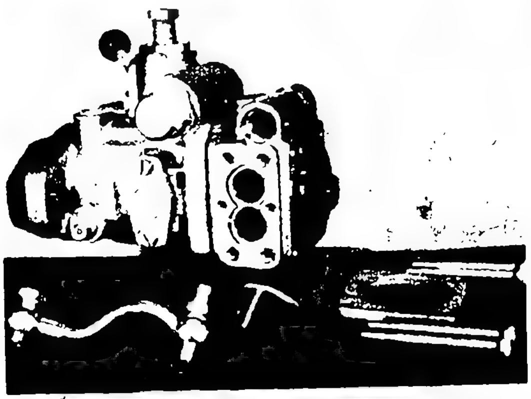
Remove delivery valve holders, delivery valves, springs, shims and space fillers, if any. Remove gaskets under delivery valves with extractor hook 1 687 959 010 Unscrew center screw plug with gasket from distributor head.

Fig. 6



Unscrew pressure equalizer end plugs. Take off O-rings. Push out helical spring and equalizer piston.

Fig. 7



Remove bleeder screw and gaskets from intermediate housing and the inlet union screw with strainer and gaskets together with fuel line from pump housing. Unscrew the four hex. socket-head screws and spring washers from intermediate housing and remove support bracket, if any, and flange.

Fig. 8

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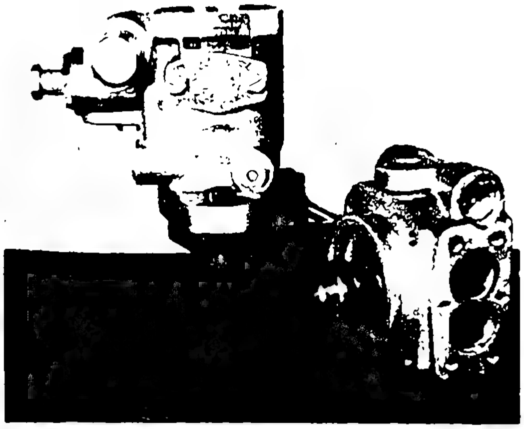
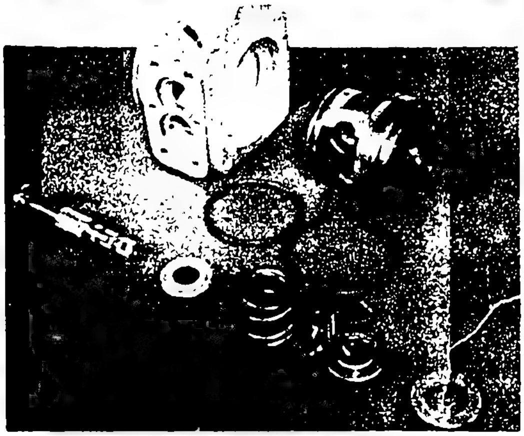


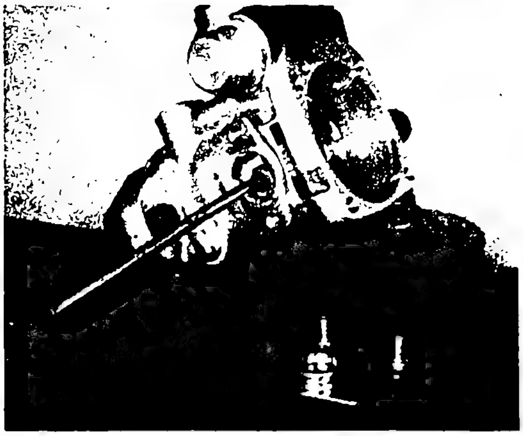
Withdraw intermediate housing from pump housing with a slight twisting movement. Remove O-ring from intermediate housing pilot side and remove the shims.

Fig. 9



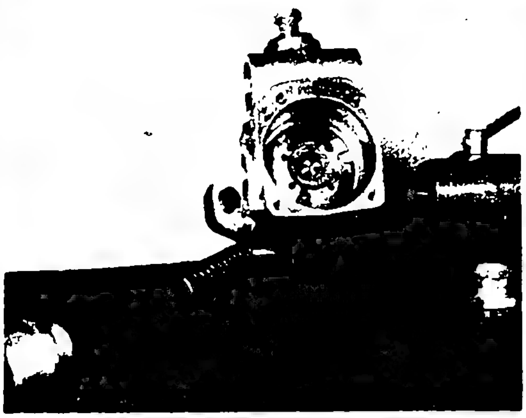
Remove distributor plunger, upper spring seat, return spring, lower spring seat and bearing.
Push distributor head out of intermediate housing and remove the two O-rings.

Fig. 10



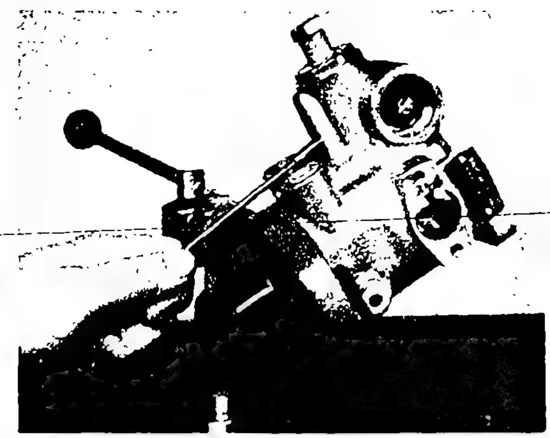
Unscrew the fillister-head screws withdraw cover and remove O-ring.
Unscrew fillister-head screw with washer and detach the timing pointer.

Fig. 11



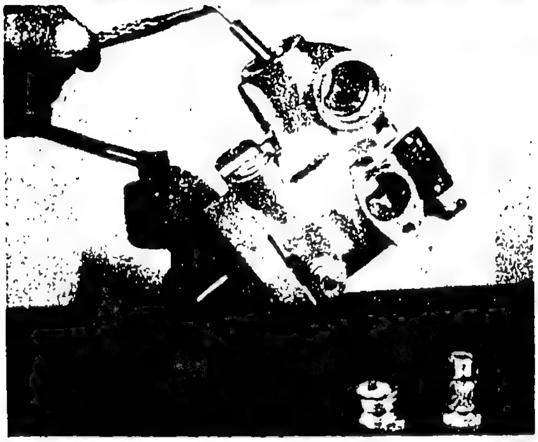
Remove automatic timing piston end cap and end plug.
Remove O-rings.
Note shims in end cap on spring side.
Remove the spring.

Fig. 12



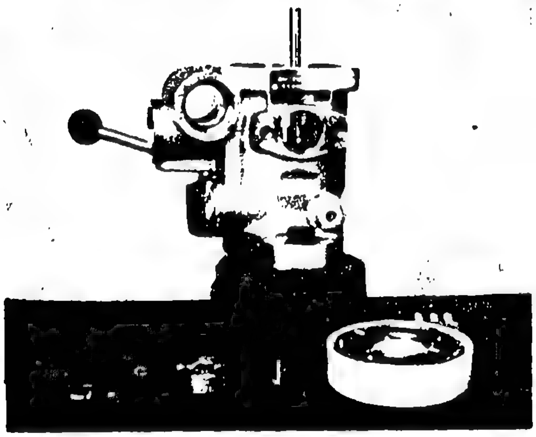
Remove screw plug with gasket.
Bring timing piston into center position and remove connecting pin with auxiliary tool.
Push out timing piston.

Fig. 13



Unscrew overflow valve and gaskets as well as top plug.
Remove O-ring.
Pull out adjusting member.
Remove connecting pin.

Fig. 14



Turn pump housing into vertical position.
Remove face cam and flexible coupling disc.
Remove roller ring and sliding block.

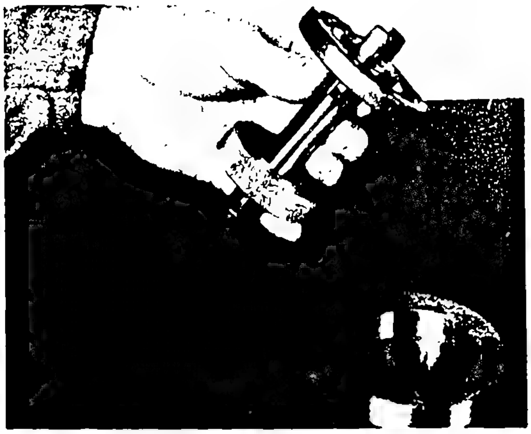
Caution:
Do not allow rollers to drop out.

Remove thrust washer.
Unscrew Phillips screws in support ring.

Fig. 15

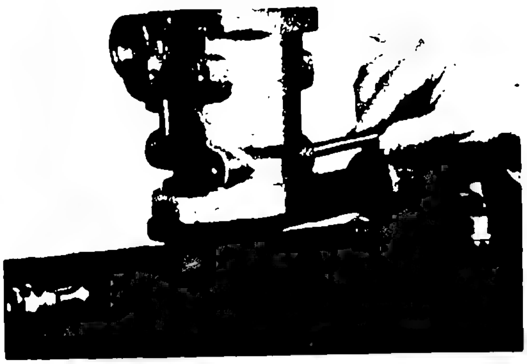
Hold driveshaft and simultaneously tilt pump housing downward.
Remove driveshaft together with support ring and complete vane-type fuel pump downwards ensuring that support ring and eccentric race do not cant.

Fig. 16



Remove eccentric race and place assembly bell (auxiliary tool self-made) over fuel pump impeller.
Invert unit and allow complete fuel pump impeller to drop into assembly bell thus storing the assembly.
Remove key and support ring from driveshaft.

Fig. 17



Remove pressure control valve screw plug.
Remove helical spring.
Unscrew valve carrier with piston and spring.
Remove O-rings.
Carefully push out poppet and seal with auxiliary mandrel.
Pull oil seal out of pump housing.

Fig. 18

3. Components inspection

Wash all individual parts and clean carefully.

Replace worn or damaged components.
The distributor head is interchangeable as a single unit complete with distributor plunger, spill piston and throttle, the pump housing together with the automatic timing piston, the intermediate housing together with the pressure equalizer piston.

Likewise, the roller ring with rollers, roller pins, washers and sliding block as also the fuel pump rotor with vanes and eccentric race are only interchangeable as single units.

Use new seals after each disassembling operation.

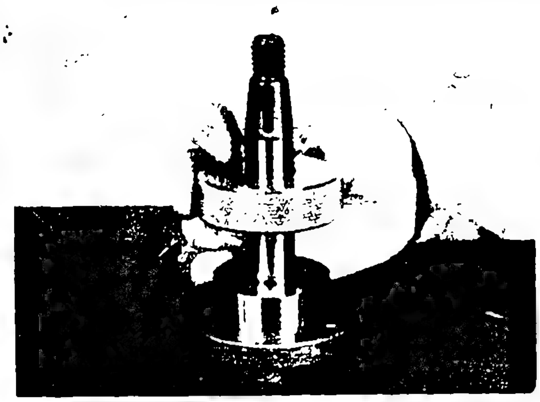
These seals are contained in parts sets (internal seals and external seals).

Prior to reassembly, submerge all components in test oil.

O-rings should be coated with tallow (or petroleum jelly) prior to installing.

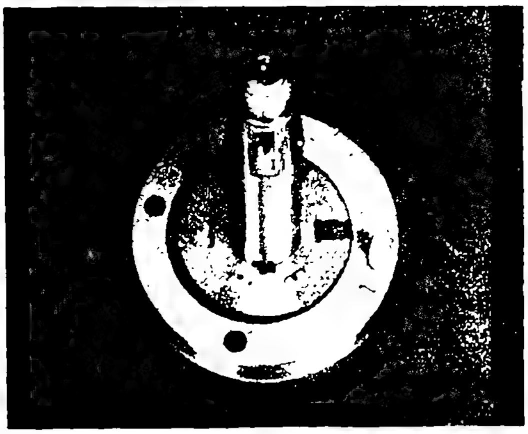
WJP 16113

4. Assembly



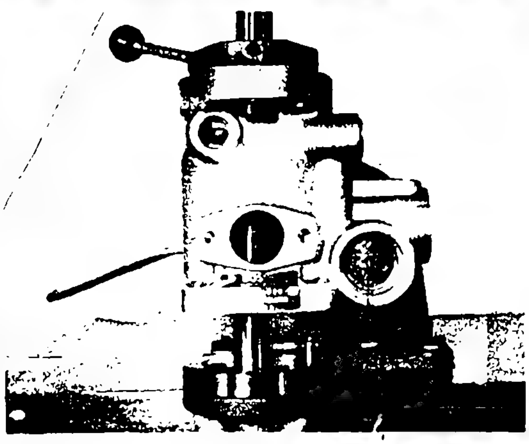
Install the support ring, key and complete fuel pump impeller (with assembly bell) on the driveshaft.

Fig. 19



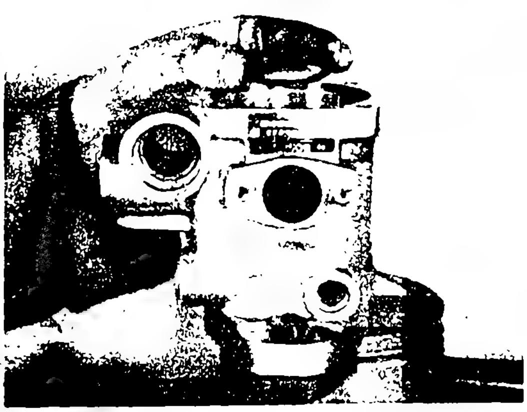
Install the eccentric race so that for a clockwise-running pump, the letter "L", or for a counterclockwise-running pump, the letter "R" is showing.
Insert a Phillips screw in the bore marked with the letter through the support ring to hold the eccentric race in place.

Fig. 20



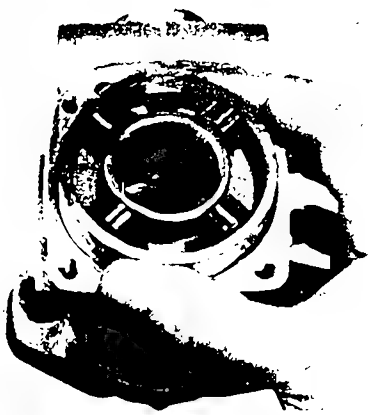
Press oil seal into position. Secure pump housing to swivel vise 0 681 240 048 using clamping bracket 1 688 120 034 and tilt downward.
Fit protecting sleeve 1 680 300 040 to prevent damage to seal.
Insert pre-assembled driveshaft from below so that the letter on the eccentric race is facing the timing piston bore.

Fig. 21



Remove protecting sleeve.
Holding driveshaft, position pump housing upright.
Secure support ring with Phillips screws.
Insert thrust washer.

Fig. 22

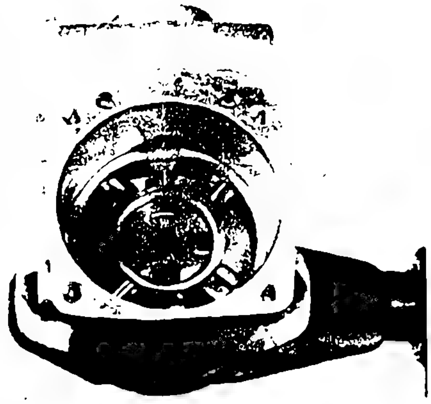


Carefully install the roller ring in the pump housing with the recess for the sliding block facing the timing piston bore.

Caution :

Do not drop or interchange the rollers.

Fig. 23

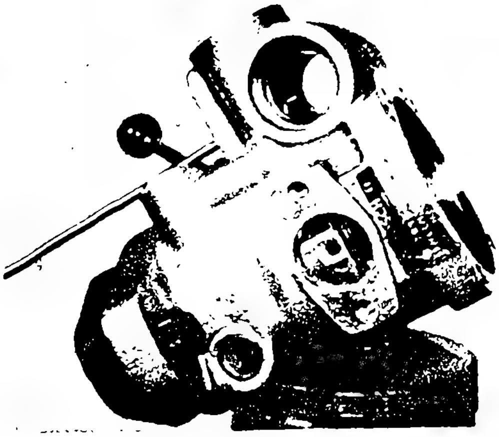


Insert the flexible coupling disc so that the roller pins cannot slide out.

Insert the sliding block into the roller ring in such a way that the milled radial surface is visible and points towards the pump center.

Insert "short" connecting pin into the sliding block.

Fig. 24



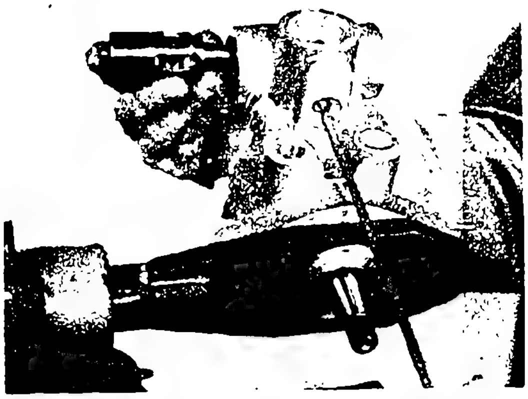
Incline the pump.

Insert adjusting member with the cutout towards the timing piston bore and closed pin hole outwards.

The "short" connecting pin must now engage.

Push "long" connecting pin through assembly bore into the adjusting member until it protrudes approx. 2 mm (5/64 in) out of the cutout.

Fig. 25



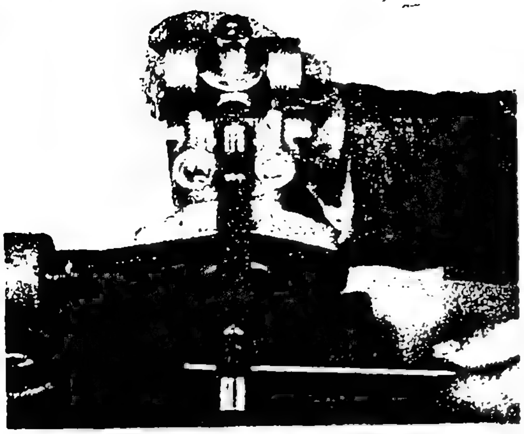
Install the timing piston with sliding block - spring end leading. Observe rotating direction of pump - viewing from drive side.

For clockwise rotation, insert the timing piston from the left, for counterclockwise rotation, from the right.

In assembling, position the bore for the sliding block vertically and the groove in the piston towards the adjusting member.

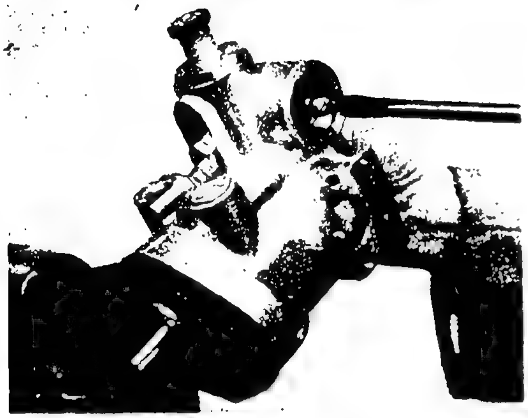
Fig. 26

1410



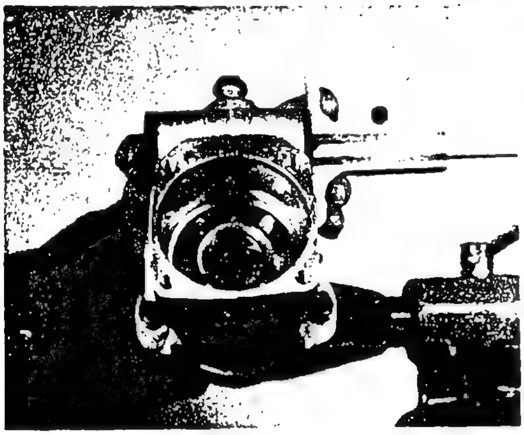
Install top plug with O-ring and overflow valve with gaskets.
Using auxiliary tool, install the "long" connecting pin into the sliding block in the timing piston.
Close off assembly bore with screw plug and gasket. Check timing piston for easy movement.

Fig. 27



Remove fillister-head screw (stop screw) with spring washer and shims, if any, from the timing piston "spring side".

Fig. 28

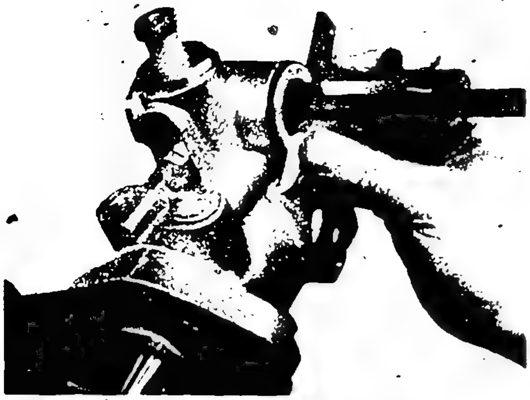


Place stop plate 1 680 022 002 on "spring side".
Screw gauge ring 1 683 458 007 into opposite end and measure the distance to the stop screw with depth gauge. The distance required is given in Test Sheet WPP 001/4..B as Measurement I.

Fig. 29

Correct dimensional deviations installing shims under the fillister-head screw and the lock washer on the "pressure side".
If the slot of the fillister-head screw is damaged, replace the screw.
Subsequently, screw end plug with O-ring into "pressure side".

Fig. 30



Screw fillister-head screw with lock washer onto "spring side".
Push piston in up to stop.
Screw gauge ring 1 683 458 007 into position and measure the distance to the stop screw with the depth gauge.
The required distance is given in Test Sheet WPP 001/4..B as Measurement II.

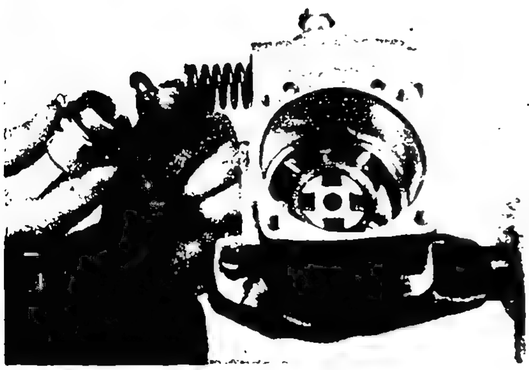
Fig. 31

Correct dimensional deviations by inserting shims under the fillister-head screw and lock washer on "spring side".
If the slot of the fillister-head screw is damaged, replace the screw.

Fig. 32

Leave the gauge ring in the housing and measure timer spring space. (Distance from surface of gauge ring to spring contact surface of piston).
The required length of the spring space is given in Test Sheet WPP 001/4..B as Measurement III.

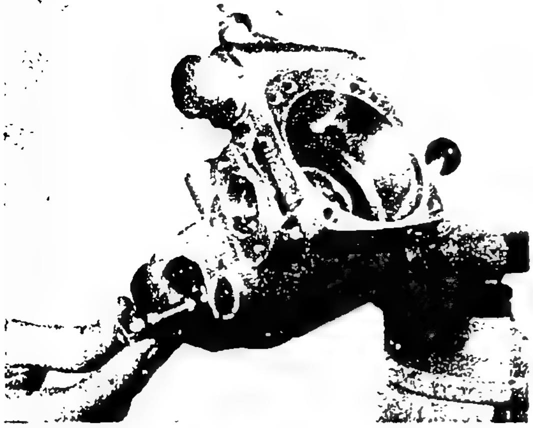
Fig. 33



Insert shims having a thickness equal to the difference between the distance required and the larger distance measured into end cap.
Unscrew gauge ring.
Insert helical spring and screw on end cap with O-ring and shims.

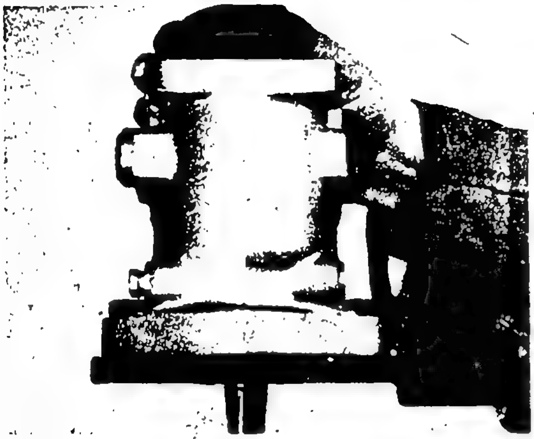
Fig. 34

18 12



Install screw plug and O-ring in the housing bore (for the pressure control valve)opposite the timing piston spring side.
Insert the helical spring from opposite end.
Insert the small valve spring and the valve piston into the valve carrier with O-ring.
Subsequently attach first the O-ring and then the poppet (taper towards O-ring) onto the pressure control valve using grease and install this assembly.

Fig. 35

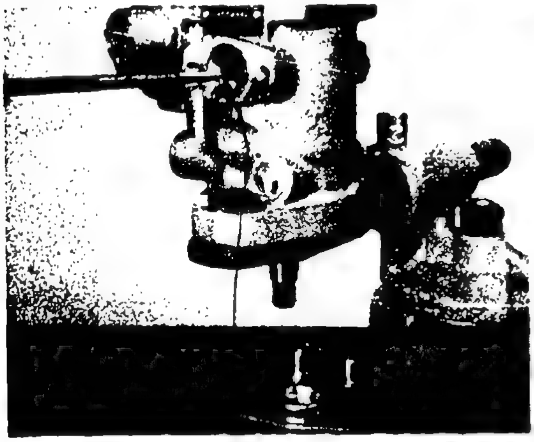


Position pump vertically and install face cam.

Caution:

Align the drive pin in the face cam with the keyway in the driveshaft.

Fig. 36



Secure timing pointer to roller ring with fillister-head screw and washer.
Install cover with O-ring and secure with fillister-head screws.

Fig. 37

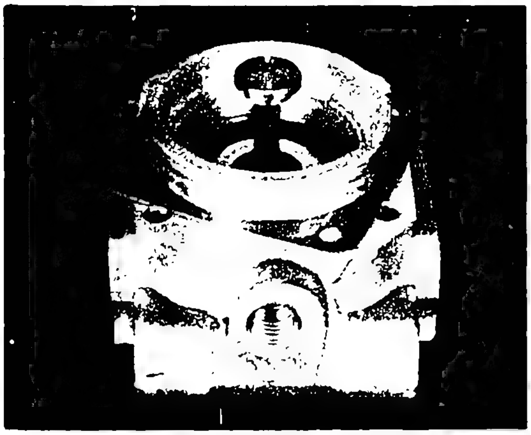
Insert O-ring into intermediate housing on locating pin side.
Insert O-ring into the groove in the distributor head.
Press the distributor head into the intermediate housing.

Caution:

Note position of locating pin and O-rings.

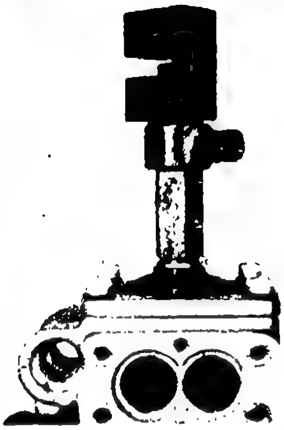
Fig. 38

20 13



Place a shim of 1 mm (0.039") thickness onto pilot side of intermediate housing.
Insert plunger without spring, spring seats and bearing into the distributor head.

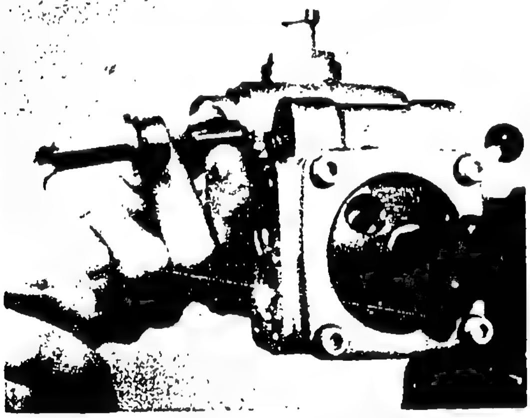
Fig. 39



Screw measuring device 1 688 130 045 with gasket into distributor head and install pre-assembled intermediate housing in pump housing.

Caution:
The groove in the plunger foot must engage with the drive pin of the face cam
Put on flange.
Insert hex. socket-head screws with spring washers and tighten.

Fig. 40



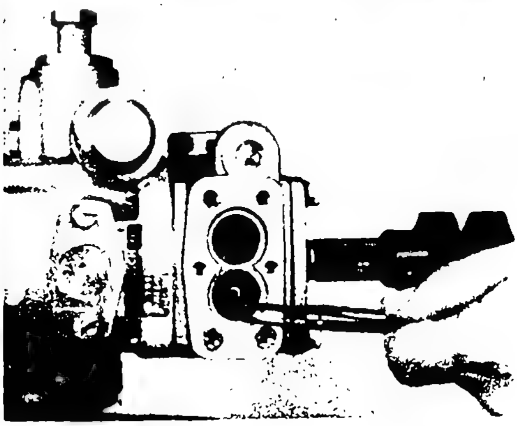
Position the pump horizontally.

Install screw plug with machined stud or countersink for spring and 0-ring into pressure equalizer bore on the L.H. side of the intermediate housing (viewed from the drive end-timing piston at top).

Insert the helical spring and then the pressure equalizer piston, stud foremost into the other end.

Install screw plug with 0-ring.

Fig. 41



Insert spill piston into <u>bottom</u> bore for <u>right</u>-mounted control levers, insert spill piston into <u>top</u> bore for <u>left</u>-mounted control levers.

Note:
"Left" or "right" looking from the drive end; "top" means towards the pressure equalizer.

Fig. 42

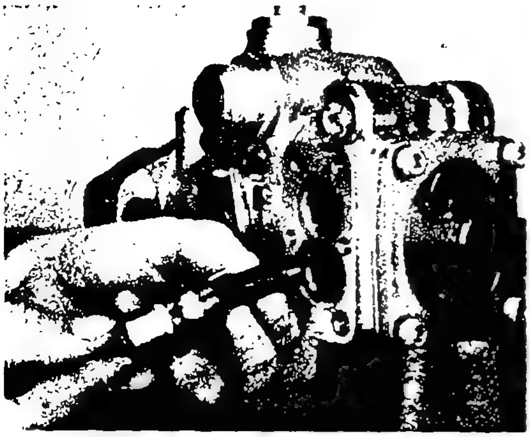


Fig. 43

Insert measuring plunger of measuring device 1 688 130 047 with large diameter leading.

Insert shaft with drive pin and bushing without 0 ring.
Place gauge ring of measuring device 1 688 130 047 in position and install this assembly.

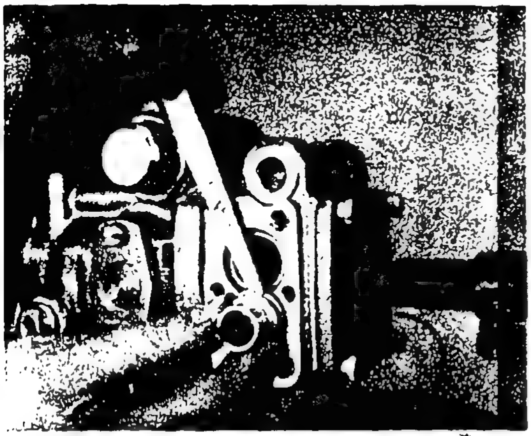


Fig. 44

Using a conventional feeler gauge, measure the distance between the gauge ring (in contact with intermediate housing) and the large shoulder of the bushing. The bushing must be pressed in while taking this measurement. Select a governor spring according to the distance measured (see table).

2416

WSP 16113

Introduire l'axe de mesure du dispositif de mesure 1 688 130 047, grand diamètre en avant.
Introduire l'axe de réglage avec goupille d'entrainement sans joint torique dans la douille sans joint torique. Poser la bague de mesure du dispositif 1 688 130 047 et introduire cet ensemble.

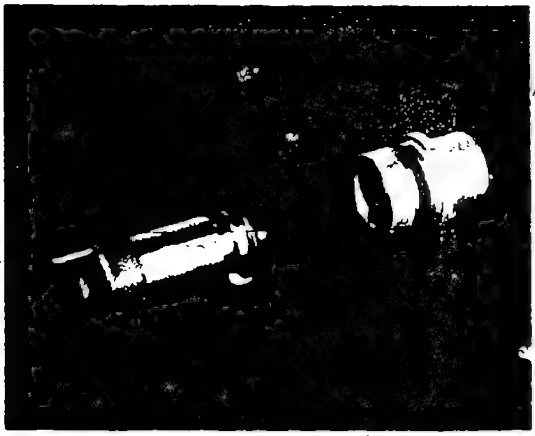
Introducir el perno del dispositivo de medición 1 688 130 047 con el diámetro grande delante.
Colocar el árbol de regulación con el pitón de arrastre sin anillo 0 en el casquillo sin anillo 0. Colocar el anillo de medición del dispositivo 1 688 130 047 e introducir esta unidad.

Avec une jauge d'épaisseur de modèle courant, relever la distance comprise entre la bague de mesure (appliquéé sur le carter intermédiaire) et le gros épaulement de la douille. Pour cela, pousser la douille vers l'intérieur.
Choisir le ressort de régulation correspondant à la cote d'écartement relevée. (Voir tableau).

Con una galga de tipo corriente en el comercio, medir la distancia entre el anillo de medición (que debe apoyar contra el cuerpo intermedio) y el reborde grande del casquillo. Al hacerlo, apretar el casquillo hacia dentro.
Elegir un resorte de regulación de acuerdo con la medida de la distancia (véase la tabla).

Distance in mm as shown in Fig. 44 Cote relevée en mm suivant fig. 44 Medida de distancia en mm según fig. 44.	Former coding by copper plating - - - Ancien symbole par cuivrage - - - - Identificación hasta ahora con cobreado - - - -	New coding by color - - - Nouveau symbole par couleur indélébile à tampon - - - - Identificación nuevo con tinta de sellar - - - -
0,5 - 0,8		
0,8 - 1,1		 red/rouge/rojo
1,1 - 1,4		 red/rouge/rojo red/rouge/rojo
1,4 - 1,7		 blue/bleu/azul
1,7 - 2,0		 blue/bleu/azul blue/bleu/azul

2846



Remove bushing, shaft and measuring device again:
Install O-ring onto shaft using assembling sleeve 1 680.390 000 and slide the bushing with O-ring onto the shaft.

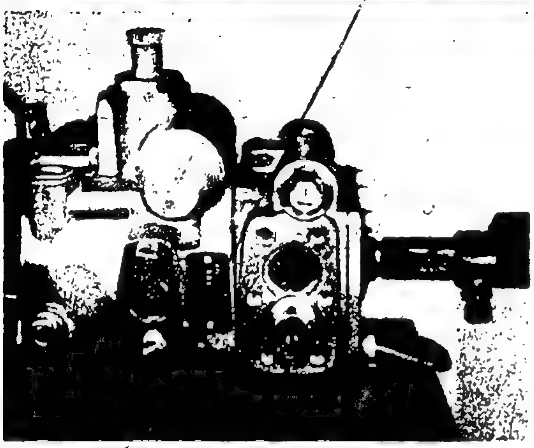


Fig. 45
Turn the spill piston so that the groove points towards the throttle bore. Insert governor spring selected into shaft and install this assembly so that the drive pin engages in the groove of the spill piston.
Do not turn shaft.

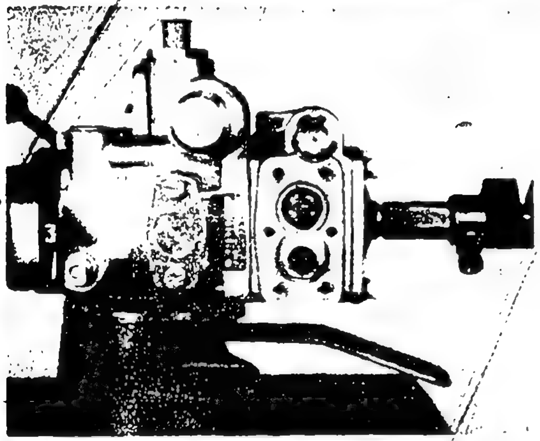


Fig. 46
Install throttle with itsspacer.
Insert cross-type disc.

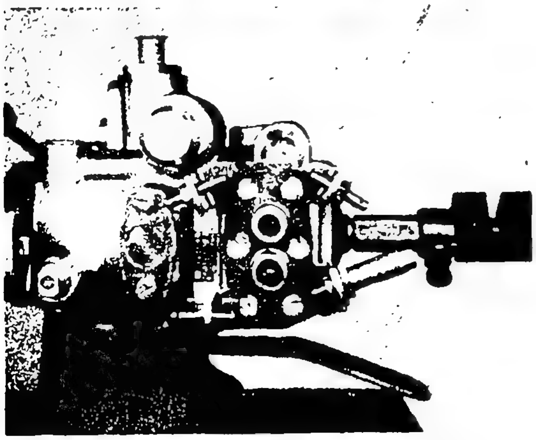
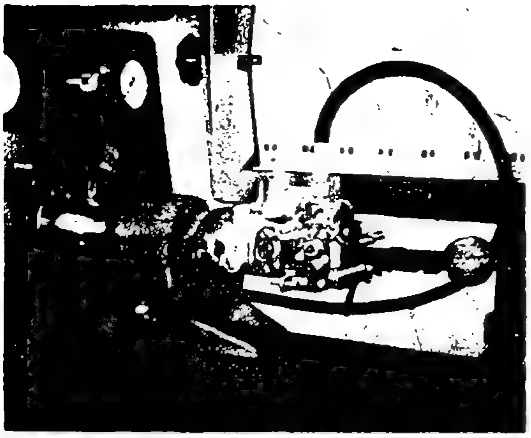


Fig. 47
Slide bushing with O-ring onto throttle shaft with O-ring.
Insert helical spring into shaft and insert this assembly so that it engages the cross-type disc.
Caution:
The marking on the threaded insert of the shaft must coincide with the marking on the claw of the throttle.
Mount stop plate securing with flat-head screws.

Fig. 48

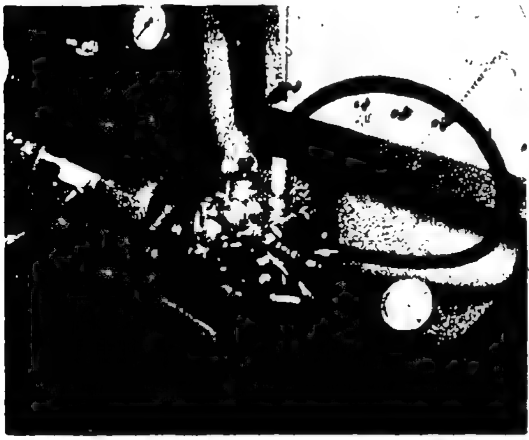
2017



Insert gaskets and delivery valves. Screw on delivery valve holders with springs, shims and space fillers as necessary.

For lift to port closure adjustment, mount pump onto injection pump test bench using the appropriate flange and clamping bracket. Install drive coupling.
Connect test oil supply hose to intermediate housing.
Mount dial indicator onto measuring device and preload in B.D.C. position to 4 mm (0.16 in). (For test bench equipment, see Test Instructions VDT-WPP 161/2 B).

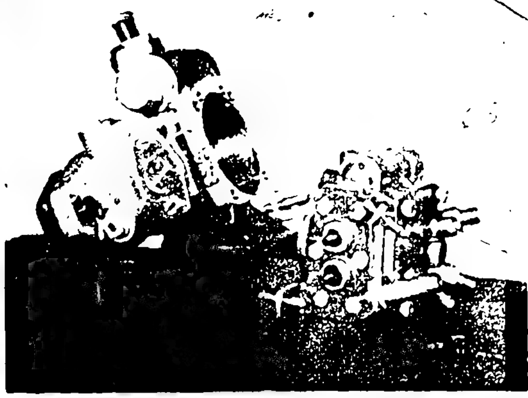
Fig. 49



Start injection pump test bench.
Set supply pressure to max. 0.2 kp/cm^2 (2.8 psi). With the distributor plunger in B.D.C., set dial indicator to "0" (test oil now flows out of the overflow tube of the measuring device).
Turn driveshaft in normal direction of rotation until no test oil flows out of the overflow tube.
Read off measurement on dial indicator.
For checking, turn driveshaft in the reverse direction of rotation.
After a max. of 0.02 mm stroke drop on the dial indicator, test oil must drip again.
If necessary, repeat lift to port closing measurement.
The required lift to port closing is given in the appropriate Test Sheet WPP 001/4.
Correct deviations by exchanging the shims under the intermediate housing.
If the lift to port closing is excessive, use thinner shims, if inadequate, thicker shims.
When setting the lift to port closing, it is advisable to aim at the lower tolerance limit.
Carry out final measurement check.

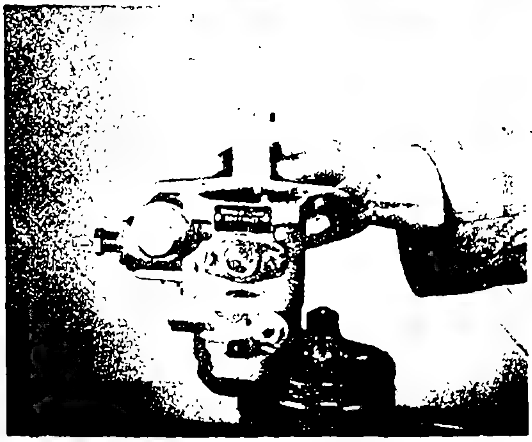
Fig. 50

2818



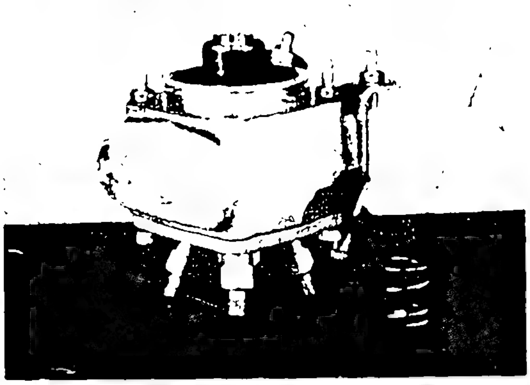
Mount pump onto swivel vise again. Remove measuring device and close off bore in distributor head with screw plug and special gasket. Unscrew hex. socket head screws and lift off complete intermediate housing.

Fig. 51



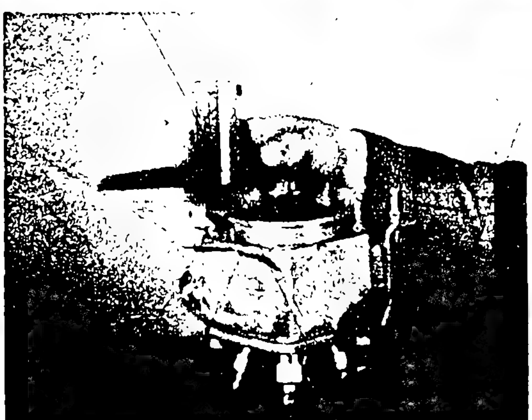
Position pump vertically.
With face cam in B.D.C., measure the distance from the joint face on pump housing - without shims - to the contact surface for plunger foot. Record measurement.

Fig. 52



Withdraw plunger from distributor head. Clamp the distributor head, intermediate housing and the appropriate amount of shims together using 2 screws.
Insert bearing, "large" spring seat - ridge towards bearing -, spacer bushing 1 680 300 039 (in place of the spring), "small" spring seat - ridge facing outward -, and plunger.

Fig. 53



Measure distance from shims to flat surface of plunger foot with depth gauge.
Caution:
Do not tilt depth gauge on inclined plunger foot.
The measurement established must agree with that recorded (see Fig. 52).

Fig. 54

WJP 16113

Correct dimensional deviations by exchanging the "small" spring seat. Replace spacer bushing 1 680 300 039 with the spring.
Unscrew clamping screws.

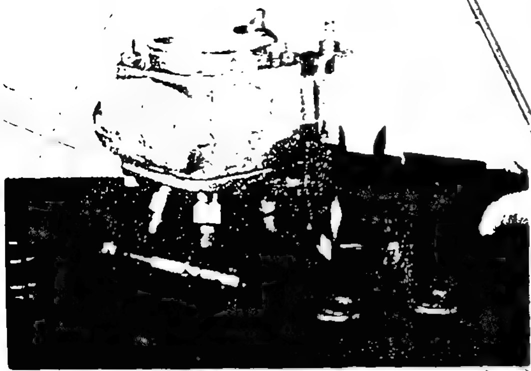


Fig. 55

Install O-ring onto intermediate housing.
Install complete intermediate housing onto pump housing and secure with hex. socket-head screws.
Caution:
The groove in the plunger foot must engage the drive pin in the face cam.

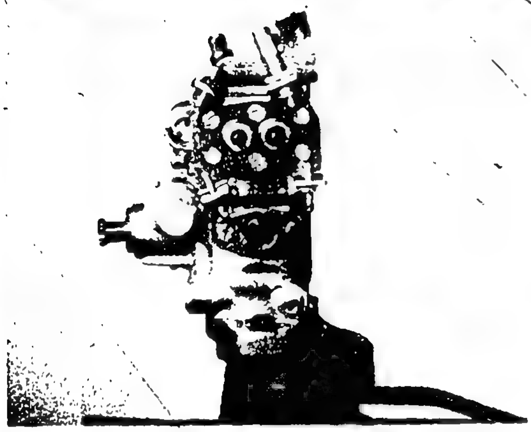


Fig. 56

Secure fuel line with inlet union screw with strainer and gaskets to pump housing, inlet union screw with bleeder screw and gaskets to intermediate housing.

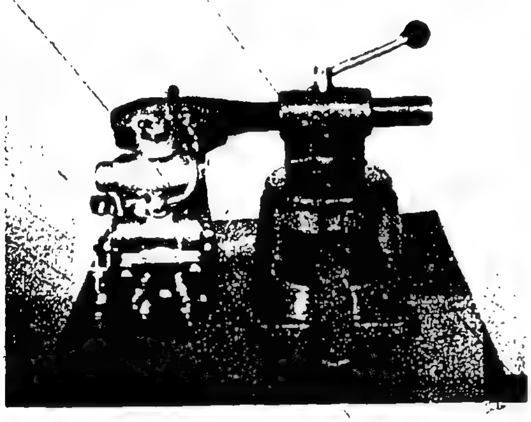


Fig. 57

Install the torsion springs.

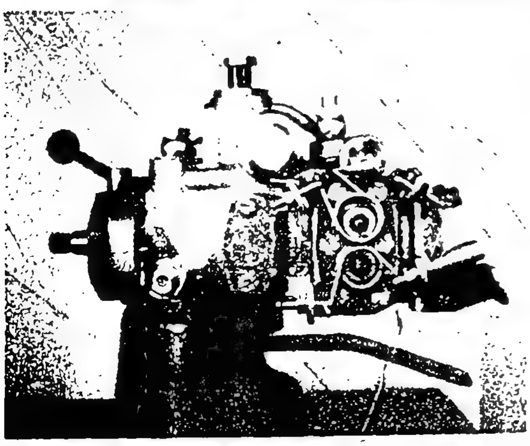
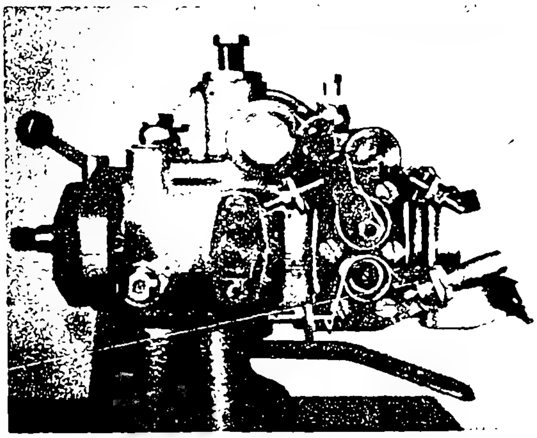


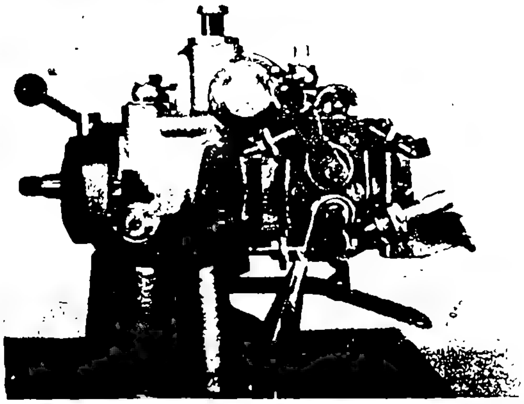
Fig. 58

3220



Install speed control lever.
Engage torsion spring.

Fig. 59

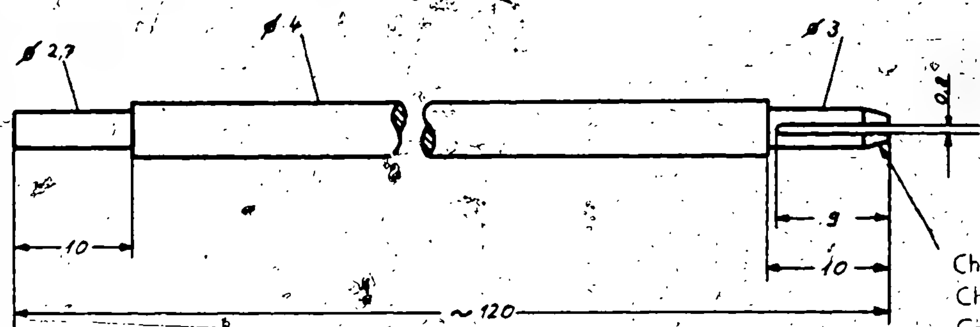


Fit washer and place stop lever in vertical position. Do not turn shaft of spill piston.
Fit lock washers.
Secure with hex. nuts.
Engage torsion spring.

Fig. 60

5. Auxiliary tools

Self-produced according to sketches below.



For removing and installing the pin connecting the adjusting member to the sliding block in the timing piston.

Pour le montage et le démontage de la goupille cylindrique reliant l'axe rotatif au coulisseau du piston d'avance à l'injection.

Para desmontar y montar el pasador cilindrico que une el perno giratorio con el táco deslizante del émbolo del variador de avance.

Monter le levier de commande de vitesse.
Accrocher le ressort de torsion.

Colocar la palanca de velocidad.
Enganchar el resorte de torsión.

Poser une rondelle et monter le levier stop en position verticale. Ce faisant, veiller à ne pas faire tourner l'axe de réglage du tiroir de régulation.
Poser des rondelles Grower.
Visser les écrous hexagonaux et les bloquer.
Accrocher le ressort de torsion.

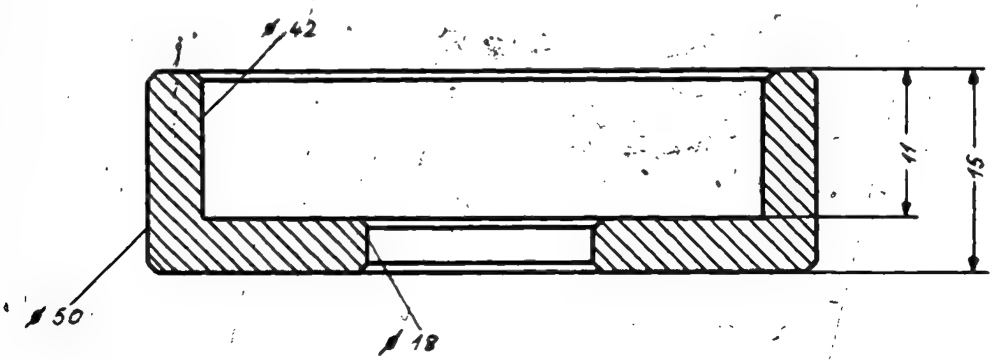
Colocar la grandela y superponer la palanca de parada en posición vertical. Al hacerlo, no girar el árbol de la corredera de regulación.
Colocar los anillos Grover.
Enroscar y fijar las tuercas hexagonales.
Enganchar el resorte de torsión.

5. Outils auxiliaires

à exécuter d'après les croquis ci dessous.

5. Herramientas auxiliares

Preparar conforme a los croquis siguientes.



Assembly bell for fuel pump rotor and vanes.

Coquille de montage pour la roue à palettes de la pompe d'alimentation avec ses palettes.

Cubierta de montaje para el rodete, con aletas, de la bomba alimentadora.

3522

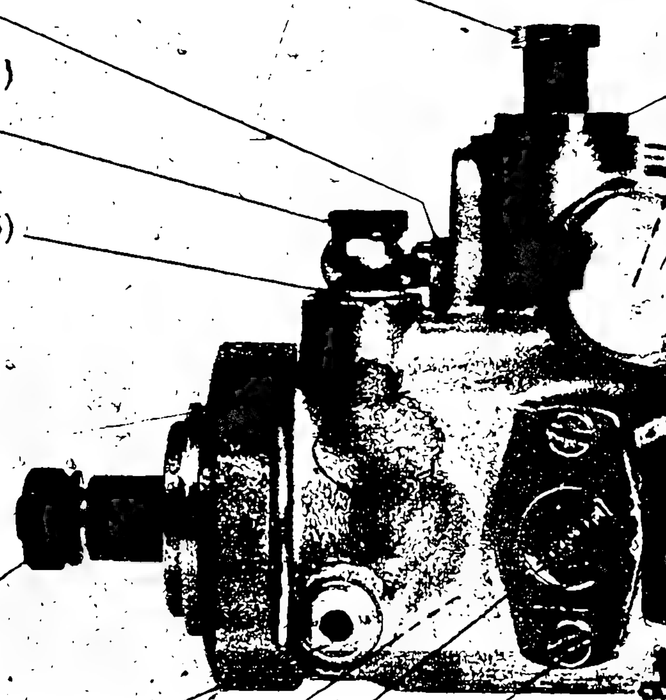
Torque values in kgm (lb.ft.) - Couple de serrag

1 2 - 2,5 (14.5 - 18.1)

2 2 - 3 (14.5 - 21.7)

3 2 - 2,5 (14.5 - 18.1)

4 4 - 4,5 (28.9 - 32.5)



5 6 - 7 (43.4 - 50.6)

6 0,8 - 0,9 (5.8 - 6.5)

7 0,55 - 0,65 (4.0 - 4.7)

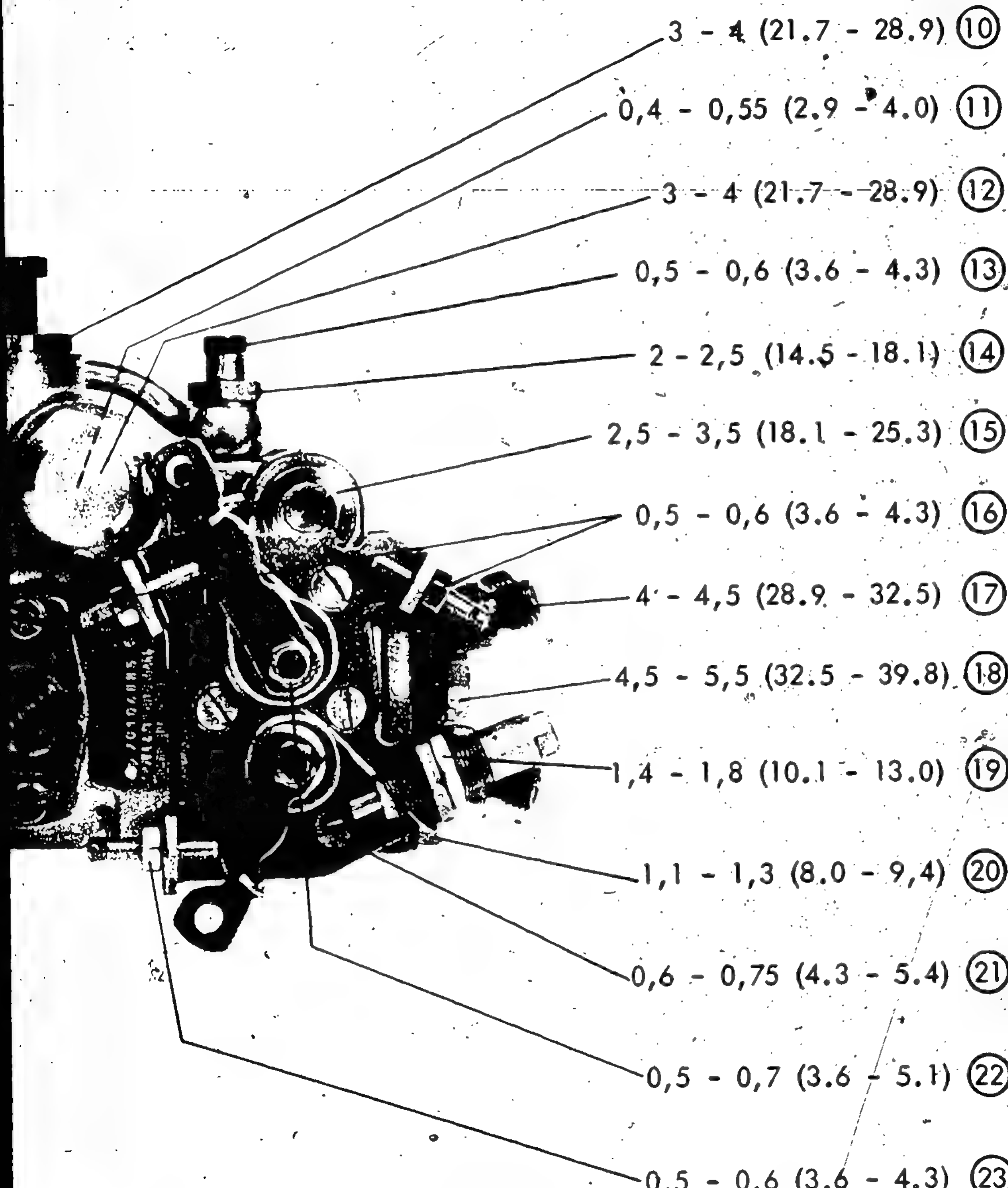
8 0,2 - 0,3 (1.5 - 2.2)

9 0,5 - 0,6 (3.6 - 4.3)

Seite 2

C3

de serrage en mkg - Pares de apriete en kgm



Seite 2

1 Overflow valve
2 Screw plug
3 Inlet union screw
4 Thread insert
5 Hex.nut with coupling mounted
6 Screw plug and valve carrier
7 Flat-head screws
8 Fillister-head screw for securing pointer
9 Fillister-head screws
10 Screw plug
11 Fillister-head screws (Stop screws) on automatic timing piston
12 Screw plugs
13 Bleeder screw
14 Inlet union screw
15 Screw plugs
16 Hex. nuts
17 Delivery valve holders
18 Screw plug
19 Hex.nut
20 Hex. socket-head cap screws
21 Flat-head screws
22 Hex. nuts
23 Hex. nut

1 Soupape de
2 Bouchon file
3 Vis creuse
4 Tubulure fil
5 Ecrou hexag d'accouplem
6 Bouchon file
7 Vis tête fra
8 Vis tête cy l'index
9 Vis tête cyl
10 Bouchon fil
11 Vis tête cy du piston d
12 Bouchons fi
13 Vis de purg
14 Vis creuse
15 Bouchons fi
16 Ecrous hex
17 Raccords d
18 Bouchon fi
19 Ecrou hexa
20 Vis à six p
21 Vis tête fr
22 Ecrous hex
23 Ecrou hexa

37

C 5

Seite 2

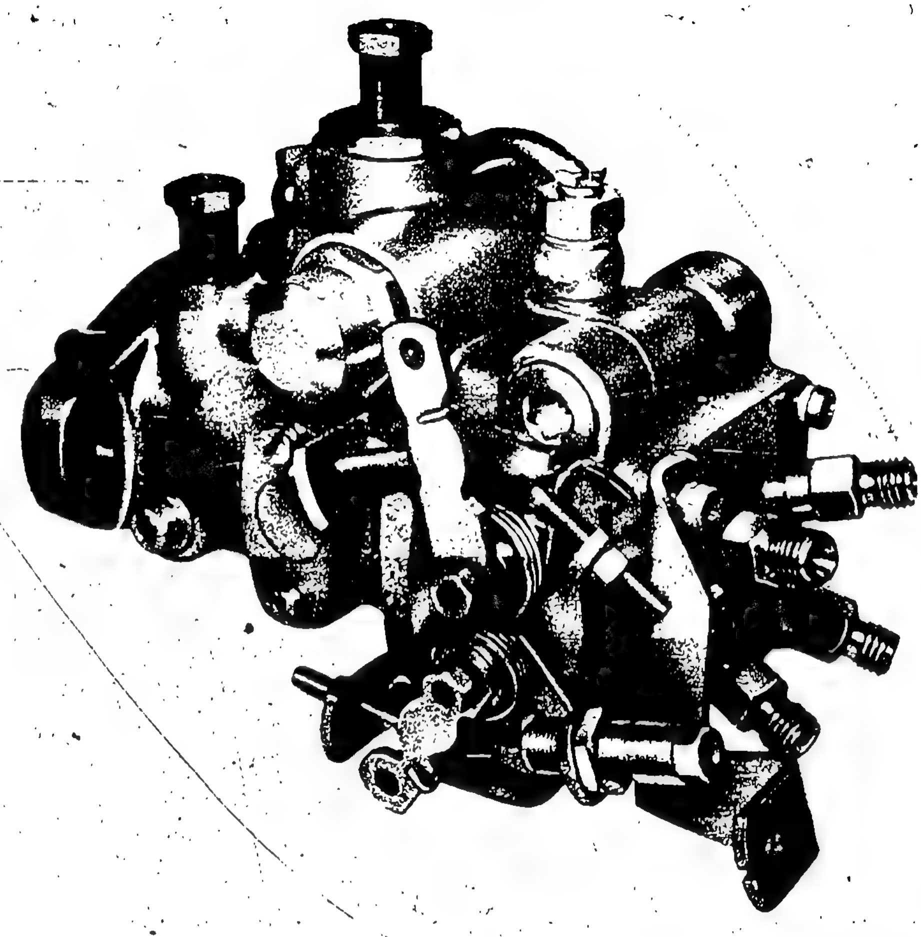
1	Soupape de décharge	1	Válvula de rebose
2	Bouchon fileté	2	Tapón roscado
3	Vis creuse	3	Tornillo hueco
4	Tubulure filetée	4	Raçor
5	Ecrou hexagonal dans le cas d'accouplement monté	5	Tuerca hexagonal con la pieza del acoplamiento montada
6	Bouchon fileté et porte soupape	6	Tapón roscado y portaválvula
7	Vis tête fraisée	7	Tornillos avellanados
8	Vis tête cylindrique pour fixation de l'index	8	Tornillo de cabeza cilíndrica para sujetar el indicador
9	Vis tête cylindrique	9	Tornillos de cabeza cilíndrica
10	Bouchon fileté	10	Niple (de reducción)
11	Vis tête cylindrique (vis butée) du piston de l'avance à l'injection	11	Tornillos de cabeza cilíndrica (tornillos de tope) del émbolo del variador de avance
12	Bouchons filetés	12	Tapones roscados
13	Vis de purge	13	Tornillo de purga
14	Vis creuse	14	Tornillo hueco
15	Bouchons filetés	15	Tapones roscados
16	Ecrous hexagonaux	16	Tuercas hexagonales
17	Raccords de tuyauterie	17	Racores de conexión
18	Bouchon fileté	18	Tapón roscado
19	Ecrou hexagonal	19	Tuerca hexagonal
20	Vis à six pans creux	20	Tornillos de hexágono interior
21	Vis tête fraisée	21	Tornillos avellanados
22	Ecrous hexagonaux	22	Tuercas hexagonales
23	Ecrou hexagonal	23	Tuerca hexagonal

BOSCH

TEST INSTRUCTIONS
INSTRUCTIONS D'ESSAI
INSTRUCCIONES DE ENSAYO

46

VDT-WPP 161/3 B/F/SP
Ed. 5.70



0 460 . .

EP/VA . . H . . B . .

Distributor-type fuel injection pump
Pompe distributrice d'injection
Bomba de inyección distribuidora

C7

C7

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1	1. Test equipment
4	2. Test conditions
5	3. Test specification sheet
10	4. Test procedure
24	5. Checking
28	6. Manifold pressure compensator
38	7. Final operations

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11	4. Processus d'essai
25	5. Vérification
29	6. Butée de pression de charge
39	7. Opérations finales

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5	2. Condiciones de ensayo
7	3. Modelo de hoja de valores de ensayo
11	4. Proceso de ensayo
25	5. Revisión
29	6. Tope de presión de carga
39	7. Operaciones finales

1. TEST EQUIPMENT (see also offer sheet)

	Part No.	Type No.
1 Clamping bracket	1 688 010 010	EFEP 157
1 Intermediate flange (see offer sheet)	1 688 720 . . .	EFEP 157..
6 Test nozzles	0 681 443 014	EFEP 182
6 Test nozzle holders — 150 kgf/cm² (2130 psi) 1 off 200 kgf/cm² (2840 psi)	1 688 901 000	EF 8511/9 G
6 Fuel-injection tubings (6 x 2 x 840 mm) see offer sheet	1 680 750 . . .	EFEP 198..
1 Testing device (pressure gauge kit with fittings)	1 688 130 075	EFEP 495 A
1 Timing-piston-travel gauge (short piston)	1 688 130 046	EFEP 459
1 Timing-piston-travel gauge (long piston)	—	KDEP 1000

Tests can also be carried out on test stands

EFEP 5.. with accessory set	1 687 000 008	EFEP 491
EFEP 25.. with accessory set	1 687 000 009	EFEP 492

in accordance with VDT-WPP 161/1 B.

1. EQUIPEMENT D'ESSAI (voir également feuille d'offre)

	Référence	Type
1 Equerre de fixation	1 688 010 010	EFEP 157
1 Flasque intermédiaire (voir feuille d'offre)	1 688 720 . . .	EFEP 157..
6 Injecteurs d'essai	0 681 443 014	EFEP 182
6 Porte-injecteur (150 kgf/cm², 1 unité à 200 kg/cm²)	1 688 901 000	EF 8511/9 G
6 Tuyauteries de pression (6 x 2 x 840) voir feuille d'offre	1 680 750 . . .	EFEP 198..
1 Dispositif d'essai (groupe de manomètres avec éléments de raccordement)	1 688 130 075	EFEP 495 A
1 Dispositif de mesure du déplacement de l'avance variable à l'injection (piston court)	1 688 130 046	EFEP 459
1 Dispositif de mesure du déplacement de l'avance variable à l'injection (piston long)	—	KDEP 1000

L'essai peut également être exécuté sur les bancs d'essai suivants:

EFEP 5.. avec jeu d'accessoires	1 687 000 008	EFEP 491
EFEP 25.. avec jeu d'accessoires	1 687 000 009	EFEP 492

suivant les instructions données dans VDT-WPP 161/1 F — 1er supplément.

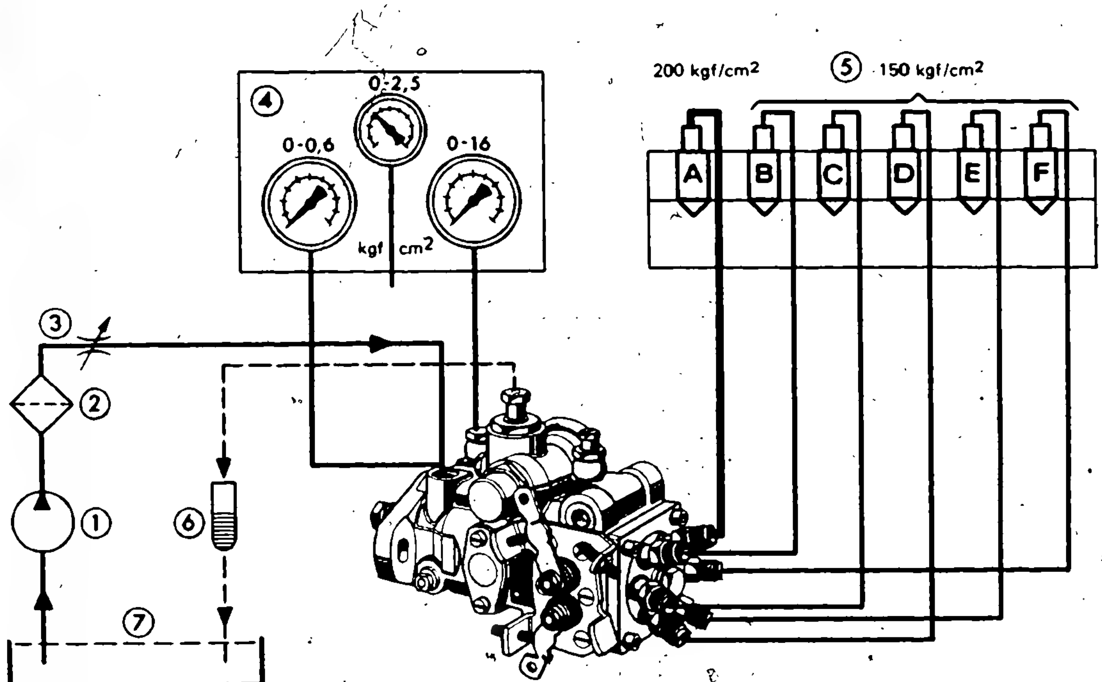
1. EQUIPO DE ENSAYO (véase también hoja de oferta)

	N° de pedido	Fórmula de tipo
1 escuadra de fijación	1 688 010 010	EFEP 157
1 brida intermedia (véase hoja de oferta)	1 688 720 . . .	EFEP 157 .
6 inyectores de ensayo	0 681 443 014	EFEP 182
6 portainyectores (150 kp/cm², 1 pieza 200 kp/cm²)	1 688 901 000	EF 8511/9 G
6 tuberías de presión (6 x 2 x 840), véase hoja de oferta	1 680 750 . . .	EFEP 198..
1 dispositivo de ensayo (juego de manómetros con piezas de conexión)	1 688 130 075	EFEP 495 A
1 dispositivo de medición de la carrera del variador de avance (émbolo corto)	1 688 130 046	EFEP 459
1 dispositivo de medición de la carrera del variador de avance (émbolo largo)	—	KDEP 1000

El ensayo puede realizarse, según VDT-WPP 161/1 SP — 1er suplemento, también en los bancos de pruebas:

EFEP 5.. con juego de accesorios	1 687 000 008	EFEP 491
EFEP 25.. con juego de accesorios	1 687 000 009	EFEP 492

Pipe-line diagram
Schéma de canalisation
Esquema de conexión de tuberías



WPP 16113

① = Fuel supply pump
② = Filter
③ = Supply pressure regulator
④ = Pressure gauge 0—0.6 kgf/cm² (8.5 psi) (feed pressure)
0—2.5 kgf/cm² (35.6 psi) (charge pressure)
0—16 kgf/cm² (228 psi) (supply pump pressure)

⑤ = Nozzle holders with nozzles
150 kgf/cm² (2130 psi)
Nozzle holder with nozzle
200 kgf/cm² (2840 psi)
on outlet A for start quantity
⑥ = Metering glass for overflow quantity
⑦ = Test oil tank

① = Pompe d'alimentation
② = Filtre
③ = Régulation de pression d'arrivée
④ = Manomètres 0—0,6 kgf/cm² (pression d'arrivée)
0—2,5 kgf/cm² (pression de charge)
0—16 kgf/cm² (pression de pompe d'alimentation)

⑤ = Porte-injecteurs avec injecteurs 150 kgf/cm²
Porte-injecteur avec injecteur 200 kgf/cm²
au départ A pour débit de démarrage
⑥ = Jauge pour mesurer le débit de décharge
⑦ = Réservoir d'huile d'essai

① = Bomba de alimentación
② = Filtro
③ = Entrada de la regulación de presión
④ = Manómetro 0—0,6 kp/cm² (presión de entrada)
0—2,5 kp/cm² (presión de carga)
0—16 kp/cm² (presión de la bomba de alimentación)

⑤ = Portainyectores con inyectores 150 kp/cm²
Portainyector con inyector 200 kp/cm²
en la salida A para el caudal de arranque
⑥ = Vaso de medición para el caudal de rebose
⑦ = Depósito del aceite de ensayo

25

C 11 Fx Fr

2. TEST CONDITIONS (see pipe-line diagram)

Test oil OI 61 v 11 is used for testing at a temperature of 40 + 5° C (104 + 9° F) and a supply-pump inlet pressure of 0.2 kgf/cm² (2.8 psi) for all speeds.

The overflow is led from the overflow valve into the test oil tank of the test stand using a plastic hose. To measure the overflow quantity it can be collected here in a measuring glass.

2.1 **The pressure gauge kit EFEP 495 A** is required for the following measurements:

Pressure gauge 0—0.6 kgf/cm² (0—8.5 psi) — for measuring the feed pressure — (check valve for protection of pressure gauge incorporated) is connected to the supply pump inlet.

Pressure gauge 0—16 kgf/cm² (0—228 psi) — for measuring the supply pump pressure — is connected to the supply pump outlet with a fitting.

Pressure gauge 0—2.5 kgf/cm² (0—35.6 psi) — for measuring the charge pressure (Section 6).

2.2 Initially bend the **high-pressure lines to nozzle holders** so that these can be connected without stress. It is advisable to mark the lines in accordance with the letters stamped on the distributor head and to connect them to the nozzle holders in the sequence A, B, C, etc., (see pipe-line diagram).

On some pump versions, it is necessary to set **one nozzle holder to 200 kgf/cm² (2840 psi)** and to connect it to **outlet** A for measuring the start quantity. This measurement is specifically stated on the appropriate test specification sheet.

2.3 **The timing-piston-travel gauge** is screwed in using an O-ring and the scale is then set to zero. Fit in accordance with direction of pump rotation:

with **clockwise rotation** — viewed from drive end — **on the left**
with **counter-clockwise rotation** — viewed from drive end — **on the right**

Note:

A new test specification sheet for distributor-type fuel injection pumps is used together with these instructions. The test sequence refers to the appropriate points.

The **check values** given separately (in brackets) on these test specification sheets require special attention.

WPP 16113

BOSCH

Distributor-type fuel injection pump

TEST SPECIFICATIONS EP

VDT-WPP 001/4 B

Edition   Replacing

Special notes:	Test instructions VDT-WPP 161/.. B For pre-adjustment see overleaf		
Nozzle	EFEP 182	Test oil	Ol 61 v 11
Nozzle holder	EF 8511/9	Outside Germany Shell	Calibration fluid B
Opening pressure	150 kgf/cm² (2130 psi)	Test oil temperature	40 + 50° C (104 + 9° F)
Fuel-injection tubing	6 x 2 x 840 mm	Feed pressure	0.2 kgf/cm² (2.8 psi)

Manufacturer:

Engine model:

All test specifications apply exclusively to BOSCH fuel injection pump test stands and BOSCH test equipment.

Pre-stroke setting mm

1. CALIBRATION OF PUMP

	rev/min		Volume difference cm³
1.1 Timing piston travel		mm	
1.2 Supply pump pressure		kgf/cm² (psi)	
1.3 Full-load quantity		cm³/1000 strokes	
1.4 Low idle			
1.5 Start			
1.6 Break-away			

2. TEST SPECIFICATIONS and in brackets = (CHECK SPECIFICATIONS)

2.1 Timing device rev/min mm

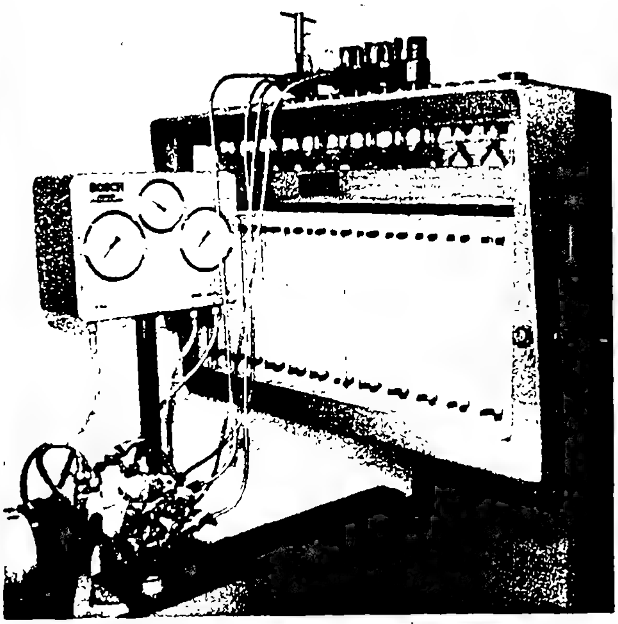
2.2 Supply pump rev/min kgf/cm²

2.3 Delivery quantities

Speed control lever	Delivery-rate control lever	rev/min	cm³/1000 strokes	Overflow quantity cm³/10 sec
Max. speed stop	Full-load			
	Shut-off			
Idling stop	Full-load			

87

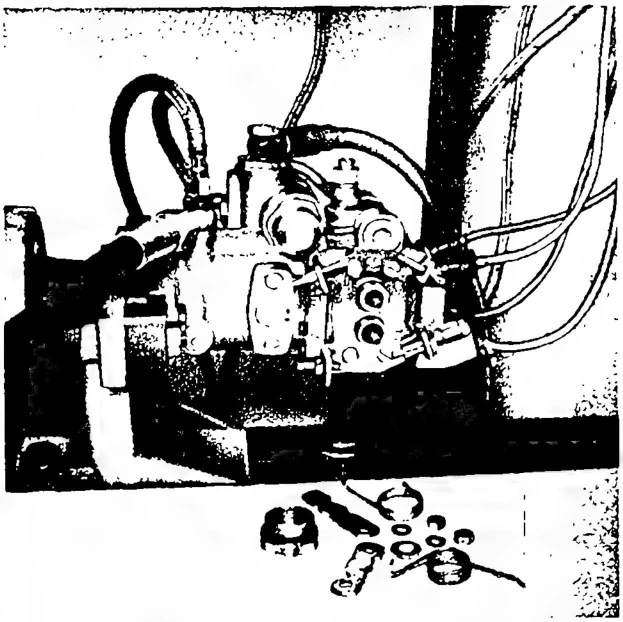
C13



1

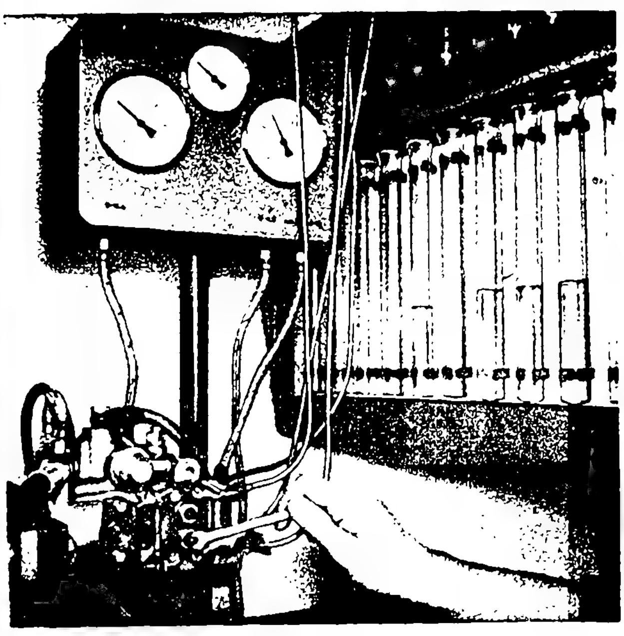
4. TEST PROCEDURE FOR NEW SETTING

4.1 Clamp pump (overflow valve at top).
Connect timing-piston-travel gauge and pressure gauge. Connect fuel supply and overflow hose as well as fuel delivery tubings with test nozzles rated 150 kgf/cm² (2130 psi), possibly one nozzle rated 200 kgf/cm² (2840 psi).



2

Open vent screws on nozzle holder and intermediate pump housing. Remove delivery rate and speed control levers. Allow pump to run at max. 100 rev/min and set feed pressure in accordance with test specification sheet. When bubble-free test oil flows out, close vent screw on intermediate housing.

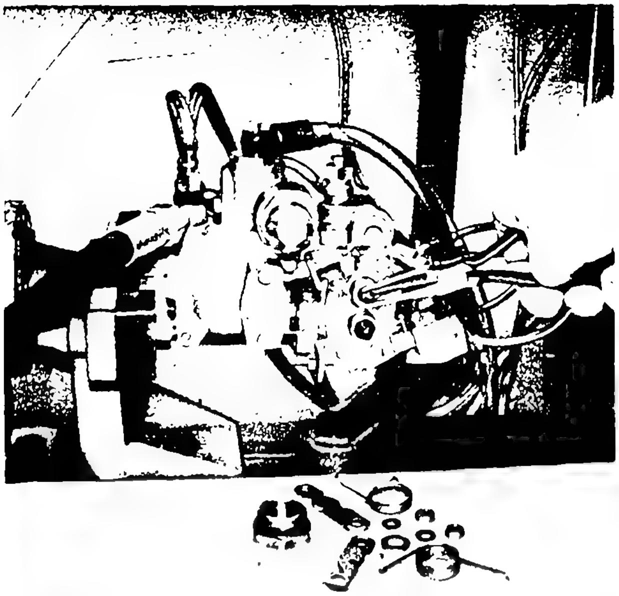


3

4.2 Presetting of spill-piston shaft and throttle shaft (initial positions).
Stop plate (seen from pump drive end)
fitted on right = delivery-rate adjustment on lower shaft
fitted on left = delivery-rate adjustment on upper shaft

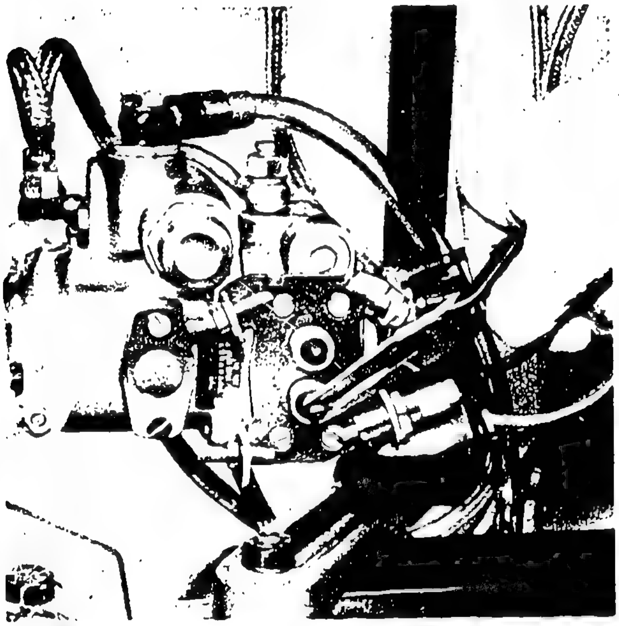
Set initial position of spill-piston shaft (approx. full-load position).
Turn top surface of spill-piston shaft square-head into horizontal position. Where present, the notch or driver slot in the spill piston points
downwards, if lever fitted on the right
upwards, if lever fitted on the left

x8



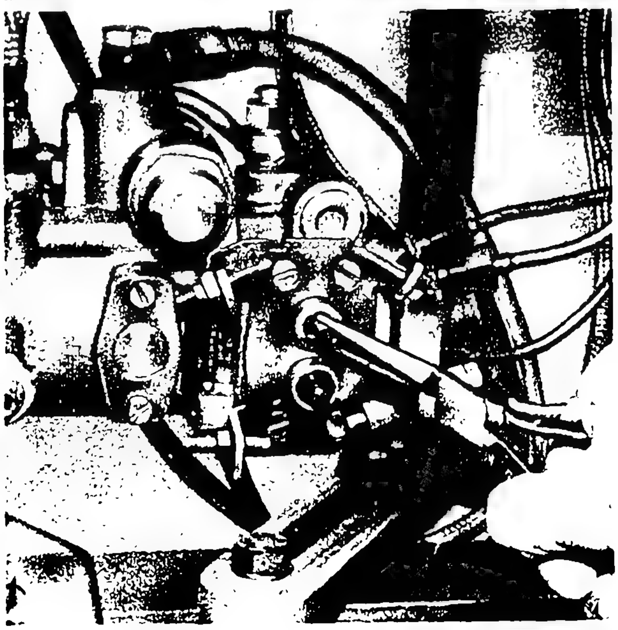
4

Throttle shaft
Turn throttle shaft square-head in direction of higher break-away speed until delivery **starts** (approx. low idle).
If no delivery occurs, turn square-head of spill-piston shaft through 90° (new initial position).
Repeat presetting of throttle shaft.
Close vent screws on nozzle holders.



5

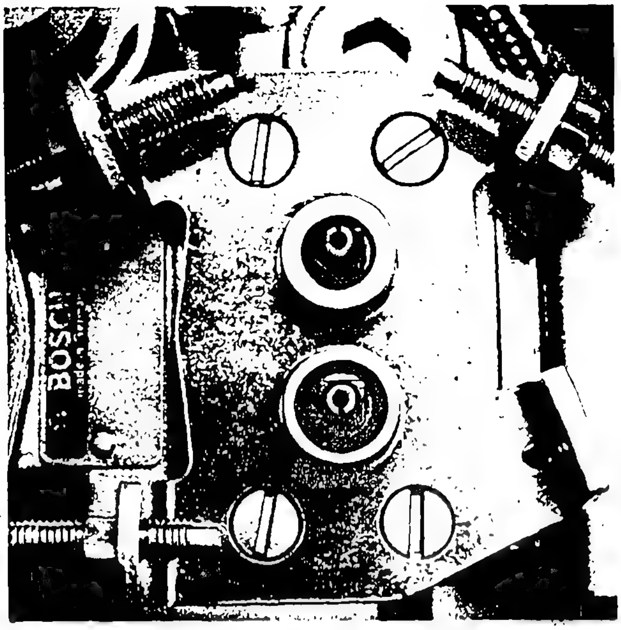
Starting check
on pumps with mechanical start-quantity control:
Turn spill-piston shaft slowly in direction of less delivery until the start quantity begins to flow suddenly just before reaching the shut-off position.
Note: The start quantity will only flow if the throttle shaft is in the idling position.
If the start quantity should fail to flow, turn spill-piston shaft through 180° (new initial position).



6

Turn throttle shaft in direction of higher break-away speed which must reduce delivery or cut out completely.
Turn spill-piston shaft (horizontal) back (approximate full-load position).

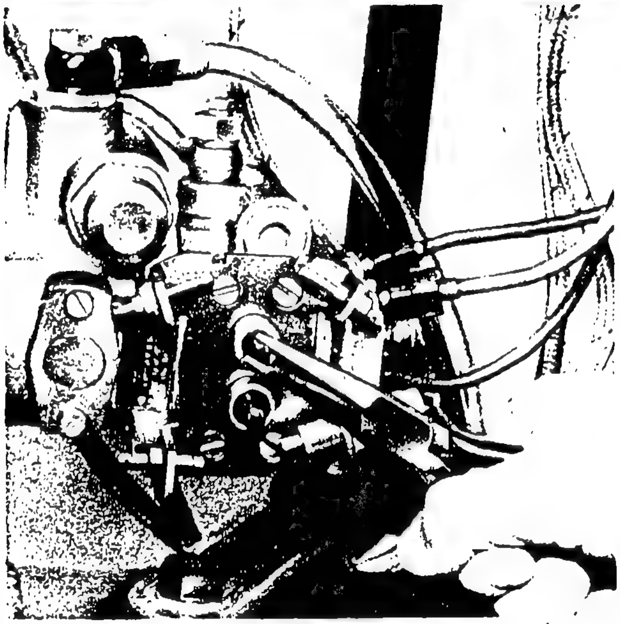
129



7

Starting check

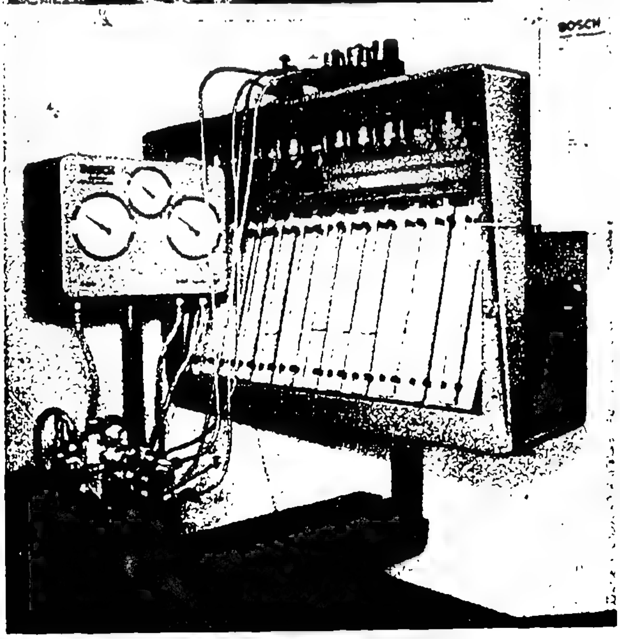
on pumps with automatic start-quantity control:
Where present, the notch on the spill-piston shaft or the driver slot on the spill piston points
downwards, if lever fitted on the right,
upwards, if lever fitted on the left.



8

Select initial position of throttle shaft.

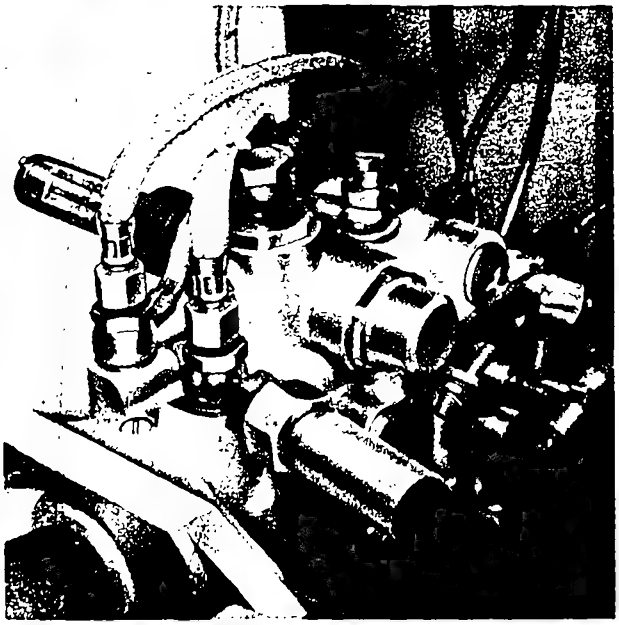
Run pump at highest speed — test specification sheet 2.3, highest value. Simultaneously turn throttle shaft square-head in direction of higher break-away speed; delivery should not cease due to this speed increase.
Turn throttle shaft square-head in direction of idling stop until the quantity delivered is reduced to approximately half.



9

4.3 **Running-in** (only necessary after repair).
Prior to starting the test procedure, the pump should be run in for approximately 20 minutes. Full-load quantity and speed should be in accordance with the appropriate test specifications.

A 10



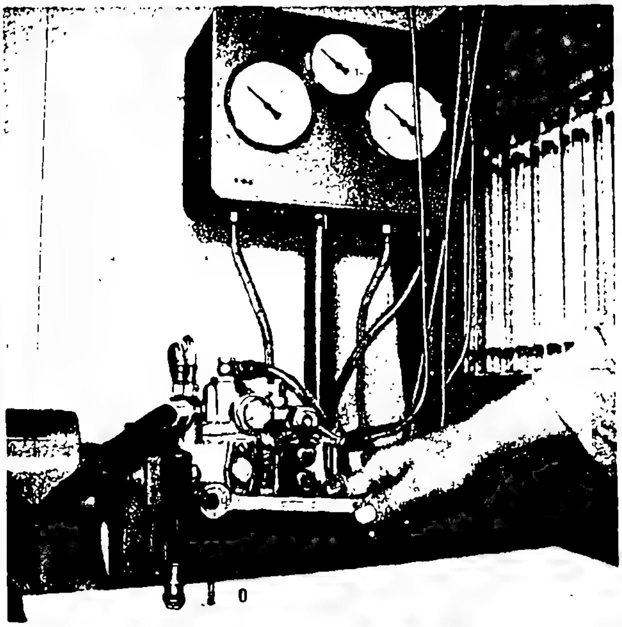
10

4.4 Adjust pump.

For calibration specifications see test specification sheet, Section 1.

Set **timing piston travel** and supply pump pressure.

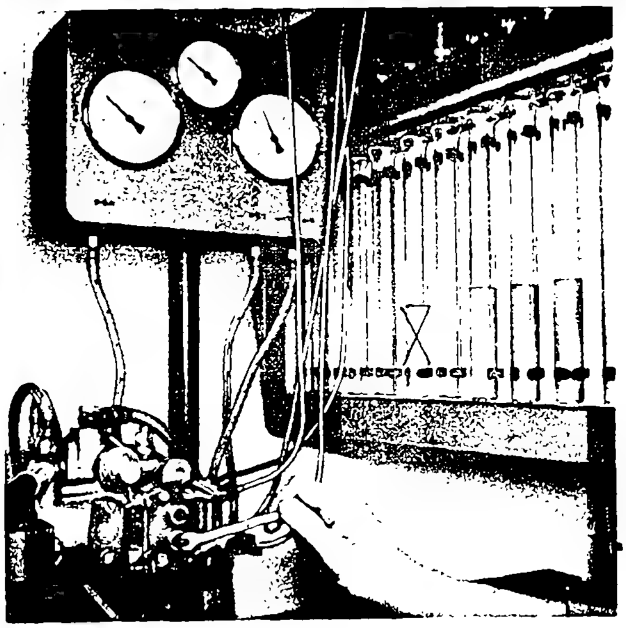
The timing piston travel is influenced by the timing piston spring and by the pressure of the supply pump. The spring preload is measured and set beforehand in accordance with VDT-WJP 161/3 B. It must therefore be corrected with shims or the spring must be renewed. The pressure of the supply pump also influences the cut-in and cut-out point of the automatic excess starting fuel control.



11

Increase **supply pump pressure** on pressure control valve by pushing the pressed-in plug inwards (for press-in tool, see Fig 27) or exchange small plungers of varying length until either the supply pump prossure or the timing piston travel and ultimately both together have the prescribed setting values.

Test specification sheet 1.1 and 1.2.



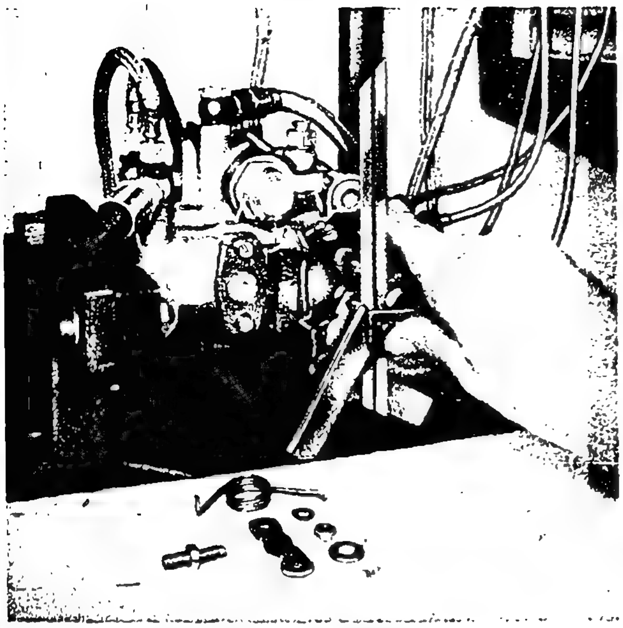
12

Set **full-load quantity** — test specification sheet 1.3 — on spill-piston shaft square-head. (Do **not** read at 200 kgf/cm² [2840 psi] outlet.) Fit torsion spring and washer.

Select delivery-rate control lever:

Control levers with and without center punch mark differ in that the gearing is offset by half a tooth.

16 41



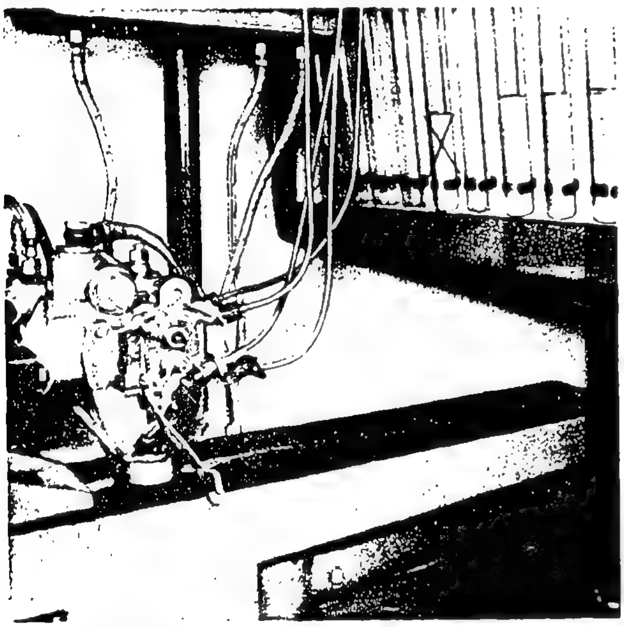
13

Fit delivery-rate control lever — angle γ.

The angle γ is the deviation of the delivery-rate control lever relative to the vertical in the direction of the full-load stop.

Fit delivery-rate control lever under angle γ in such a way that the spill-piston shaft is not rotated while fitting.

If the lever cannot be fitted in this position, use the other lever (center punch marking?).



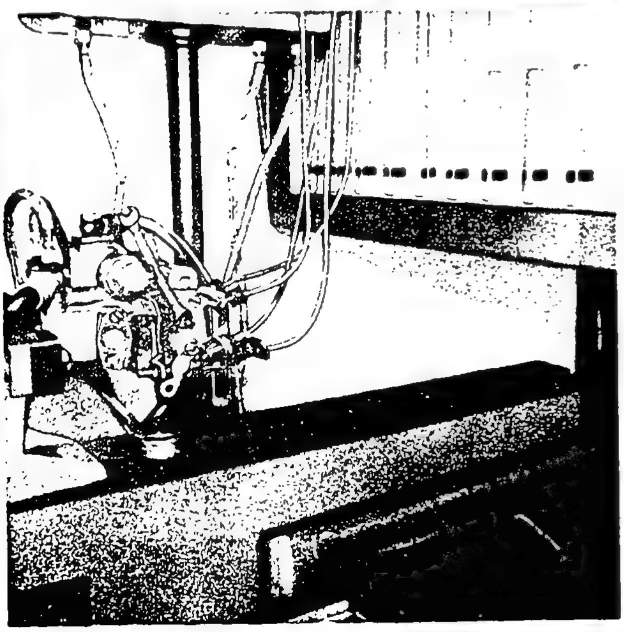
14

Bring full-load stop screw into contact with fitted delivery-rate control lever. Do not rotate spill-piston shaft while doing this! Fit spring washer and nut, and hook in the torsion spring.

On pumps without spring-loaded start and shut-off stop, check whether the shut-off position can be reached by adjusting the delivery-rate control lever. If this is not the case, use the other lever (center punch marking?); make full use of angle tolerance.

Delivery-rate control lever to full-load.

Correct full-load quantity on stop screw in accordance with test specification sheet 1.3 (do not read at outlet 200 kgf/cm² (2840 psi)).

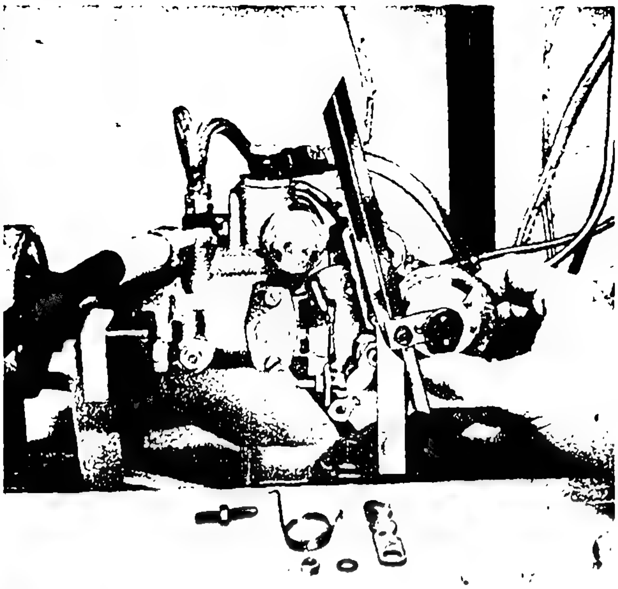


15

Set low idle — test specification sheet 1.4.

Turn throttle shaft square-head in direction of lower break-away speed until the low-idle quantity is reached. During this adjustment delivery-rate control lever will be in contact with the full-load stop. Fit torsion spring.

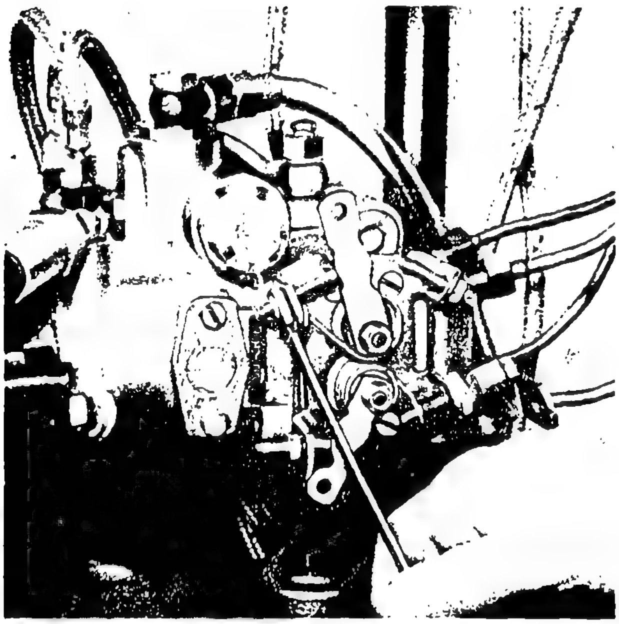
16 12



16

Select speed-control lever
In addition to levers with and without center punch mark there are also speed control levers with flanged-on strap. On versions of this type, the strap can be adjusted relative to the lever by approx. half a tooth.

Fit speed control lever — angle α.
The angle α is the deviation of the speed control lever relative to the vertical in the direction of the idling stop.
Fit speed control lever under angle α in such a way that the throttle shaft is not rotated while doing this.
If the lever cannot be fitted in this position, use the other lever (center punch mark?) or modify position of strap relative to control lever.

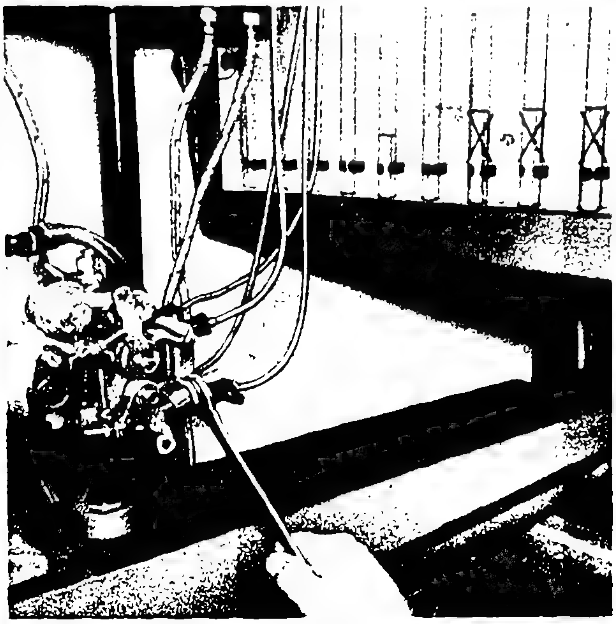


17

Bring idling stop screw into contact with fitted speed control lever. Do not rotate throttle shaft while doing this and then fit spring washer and nut.

Spring-loaded idling and shut-off stop — if provided, check 10° angle by overcoming spring pressure.

Low idle — test specification sheet 1.4.
Correct quantity on idling stop screw (do **not** read at 200 kgf/cm² [2840 psi] outlet).
The delivery-rate control lever should be in contact with the full load stop, the speed control lever with the idling stop which should not be compressed.



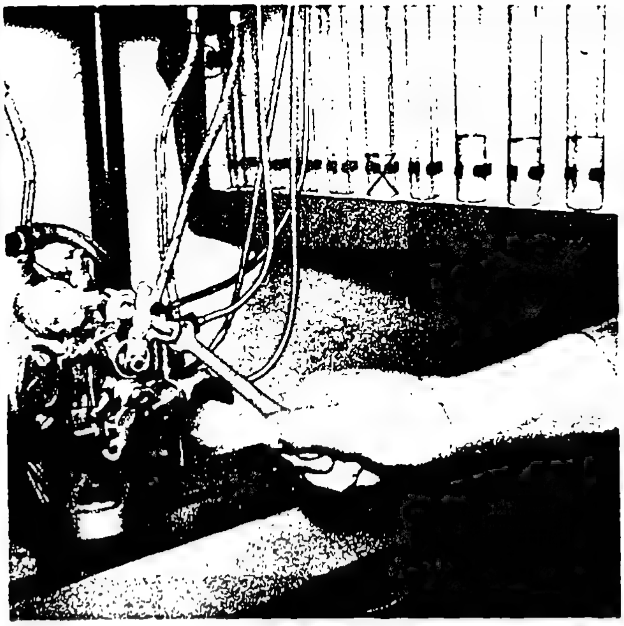
18

Set mechanical start-quantity control — test specification sheet 1.5.
Speed control lever in contact with idling stop.
Pull delivery-rate control lever in shut-off direction until just before reaching the shut-off position the start quantity cuts in suddenly.

Bring spring-loaded start und shut-off stop into contact with delivery-rate control lever (do not compress spring).
If necessary, correct start quantity — **but only read at 200 kgf/cm² (2840 psi) outlet.**
Check shut-off and start shut-off angle of 10° by overcoming spring pressure.

Set automatic start-quantity control — test specification sheet 1.5.
The supply-pump pressure influences the cut-in and cut-out point of the automatic start-quantity control.
If correction should be necessary, it is essential to observe the tolerance band of supply pump pressure and timing-piston travel.
The angle δ is the overall deflection of the delivery-rate control lever (full-load to shut-off).

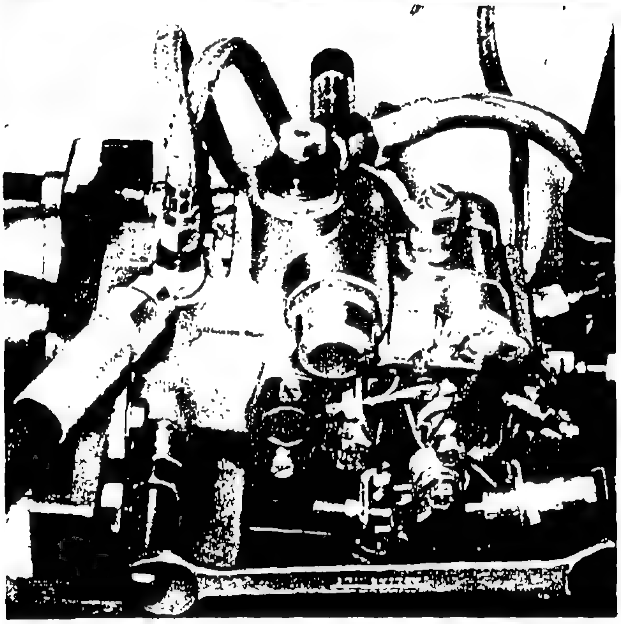
20 13



19

Set break-away — test specification sheet 1.6.
Turn speed control lever in direction of higher break-away speed until full delivery starts.
Turn speed control lever in idling direction until delivery quantity is in accordance with test specifications.
Bring stop screw into contact with control lever.
Correct delivery quantity on stop screw in accordance with test specification sheet. (Do **not** read at 200 kgf/cm² [2840 psi] outlet.)
Delivery-rate control lever in full-load position, speed control lever in contact with maximum speed stop.

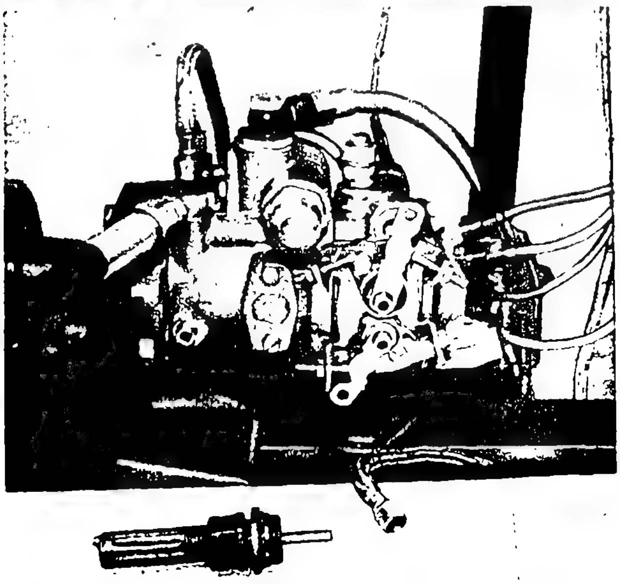
The angle β is the overall deflection of the speed control lever (idling speed — maximum speed).



20

4.5 Check pump

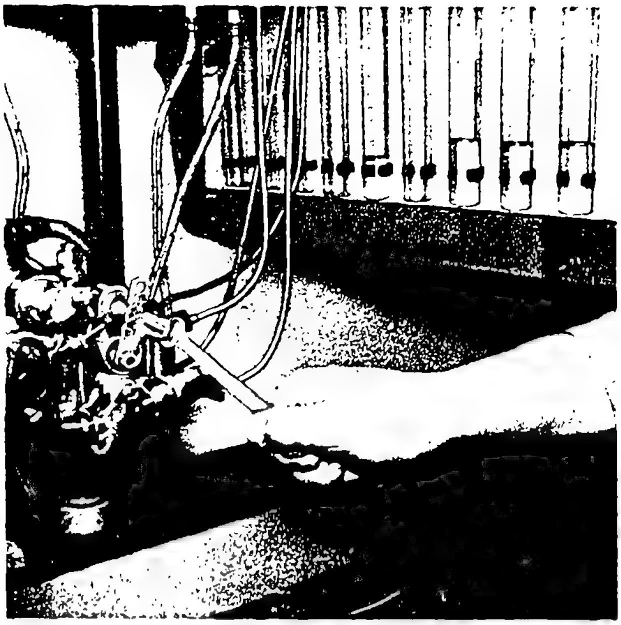
Test specifications section 2 — values not in brackets.
Delivery-rate control lever in full-load position, speed control lever in contact with maximum speed stop.
Timing-piston travel — test specification sheet 2.1
Supply pump pressure — test specification sheet 2.2
Check the above and correct within tolerances.



21

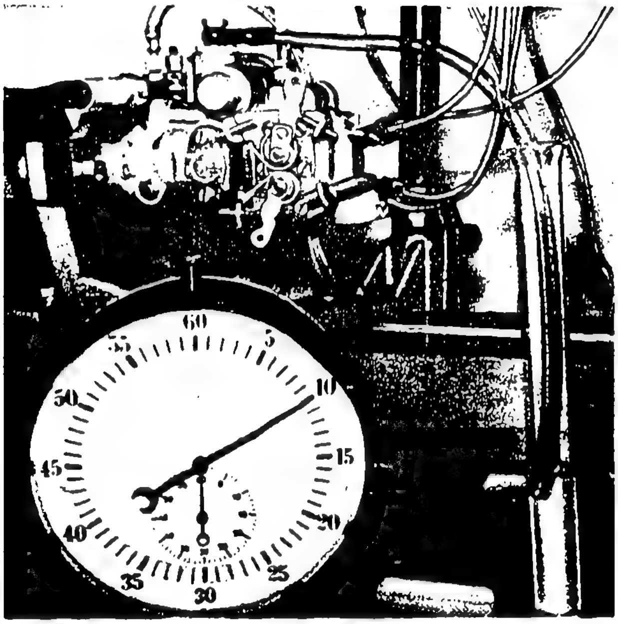
Remove timing-piston travel gauge and pressure gauge for supply-pump pressure.

2x 14



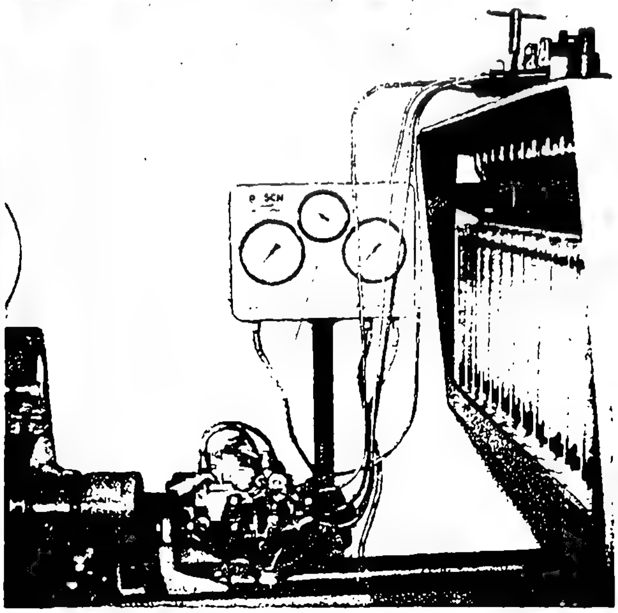
22

Delivery quantities — test specification sheet 2.3.
Check values not in brackets and correct if necessary. Do **not** read at 200 kgf/cm² (2840 psi) outlet when checking full-load and partial-load quantities.
Start quantities — if stated in the test specification sheet — should **only be read at the 200 kgf/cm² (2840 psi) outlet.**



23

Check overflow quantity — test specification sheet 2.3.
If the measured quantities lie outside the test specifications, the pump may, for example, have internal leakages or the overflow valve, pressure equalizer, etc., may be defective.



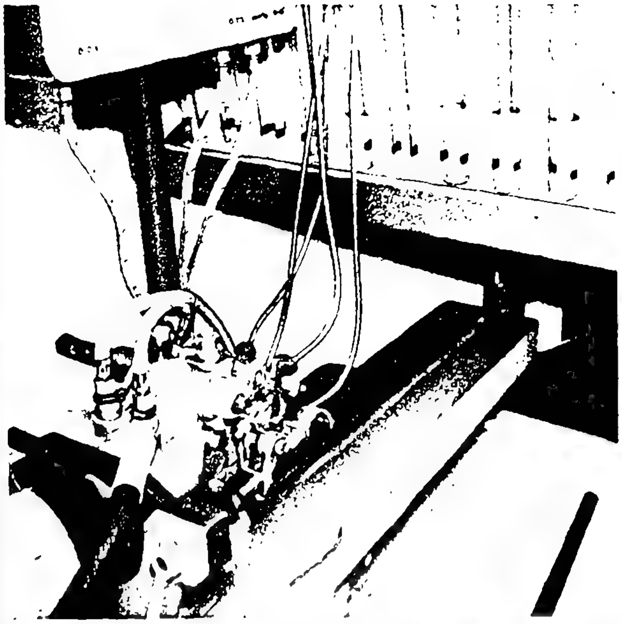
24

5. CHECKING

5.1 Clamp pump into position — with overflow valve at top.
Check pre-stroke and pointer setting — see VDT-WJP or VDT-WEP.

Connect timing-piston-travel gauge and pressure gauge.
Connect fuel supply and overflow as well as fuel injection tubings and test nozzles.
Open vent screws on nozzle holder and intermediate housing.
Allow pump to run with max. 100 rev/min and set feed pressure to 0.2 kgf/cm².
Close vent screws as soon as bubble-free test oil flows out.

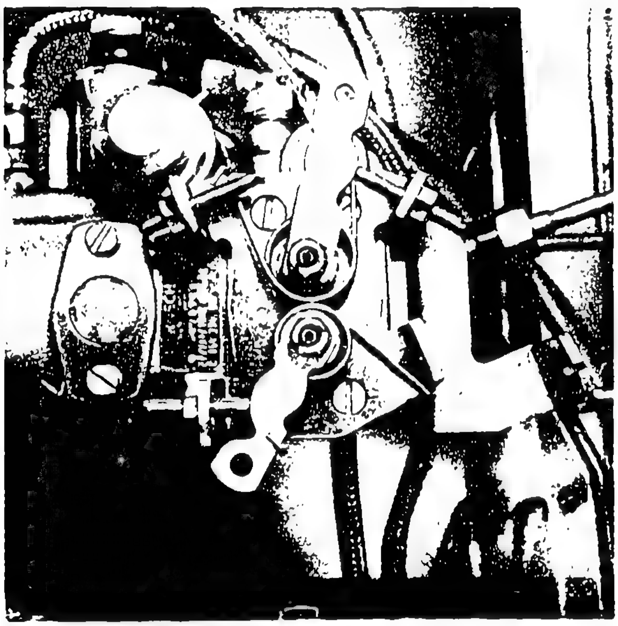
⅋ 15



25

5.2 Check timing device and supply-pump pressure

Timing device check specifications — test specification sheet 2 1 and
supply pump check specifications — test specification sheet 2.2,
only check values in brackets and record.

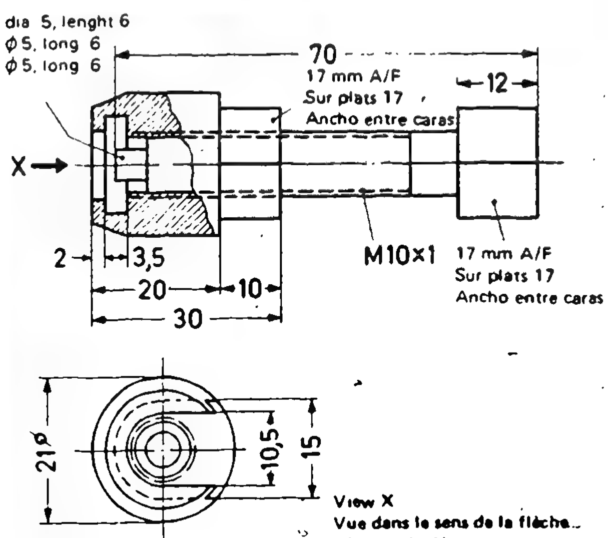


26

5.3 Check delivery quantities.

Delivery quantity check specifications — test specification sheet 2 3,

only check values in brackets and record.
After study of recorded values decide whether setting can be corrected or whether any repair work including readjustment is necessary.

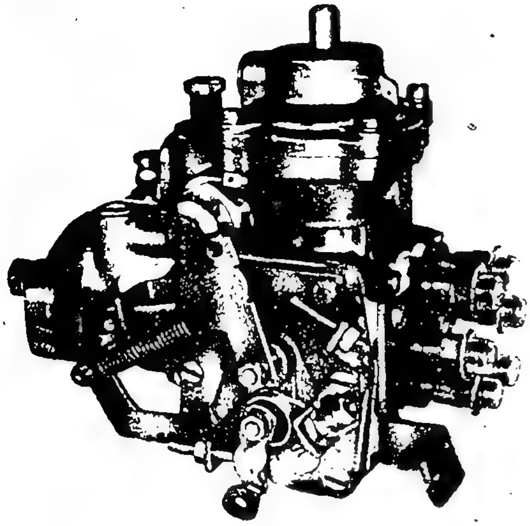


27

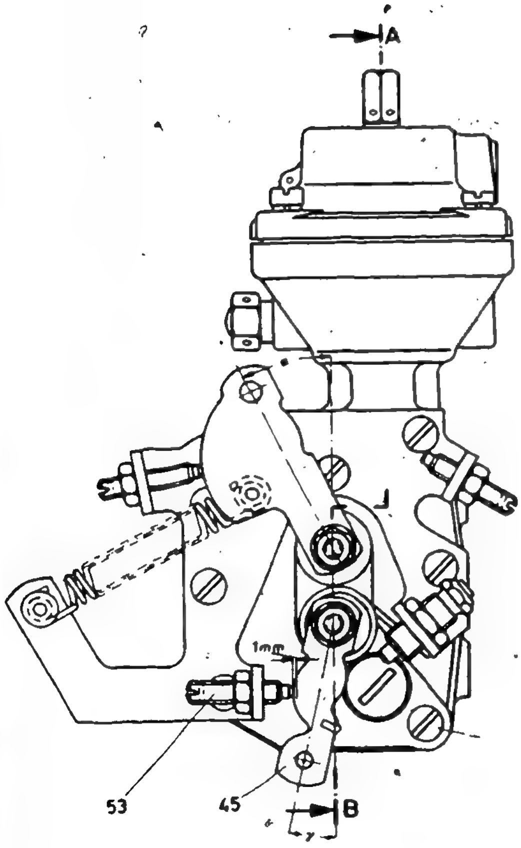
Setting tool for pressure control valve (home made).

≁ 16

6. INTAKE-MANIFOLD PRESSURE-COMPENSATOR
(charge-pressure-responsive full-load stop)
Setting



28

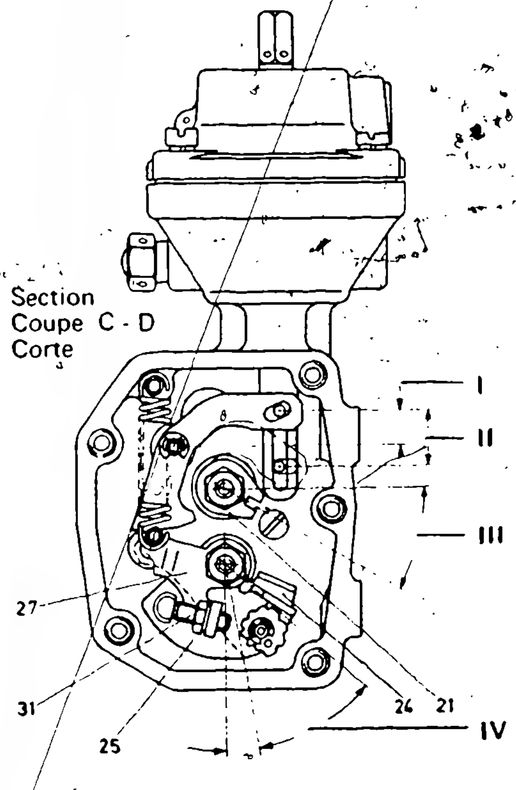


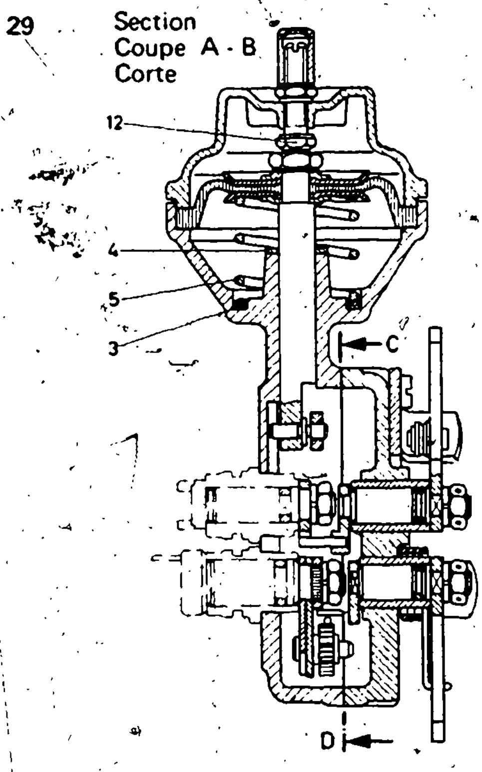
3817

6. BUTÉE DE PLEINE CHARGE TRAVAILLANT SUIVANT LA PRESSION DE LA CHARGE

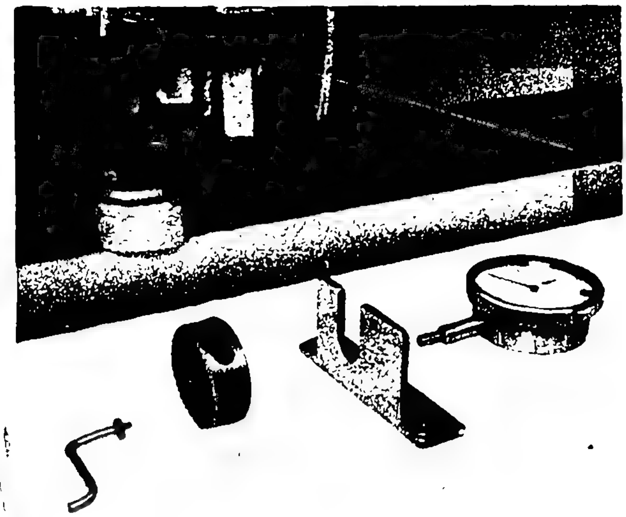
(limiteur de fumée). –
Régler cette butée.

6. AJUSTAR EL TOPE DE PLENA CARGA DEPENDIENTE DE LA PRESION DE CARGA (limitador de humos).



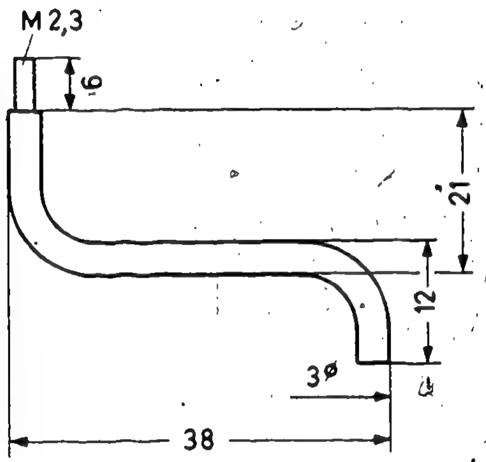


I	II	III	IV
Basic setting dimension with O charge pressure	Displacement travel at maximum charge pressure	Idling position, part 21	Fitting range for driver on delivery-rate control lever
Cote de réglage de base pour pression de charge nulle	Course de réglage pour pression de charge maximum	Position de ralenti pièce 21	Plage de montage pour l'entraîneur du levier des débits
Cota de ajuste básico con presión de carga 0	Carrera de regulación con presión de carga máx.	Posición de ralenti (pieza 21)	Margen de montaje para el arrastrador en la palanca del caudal



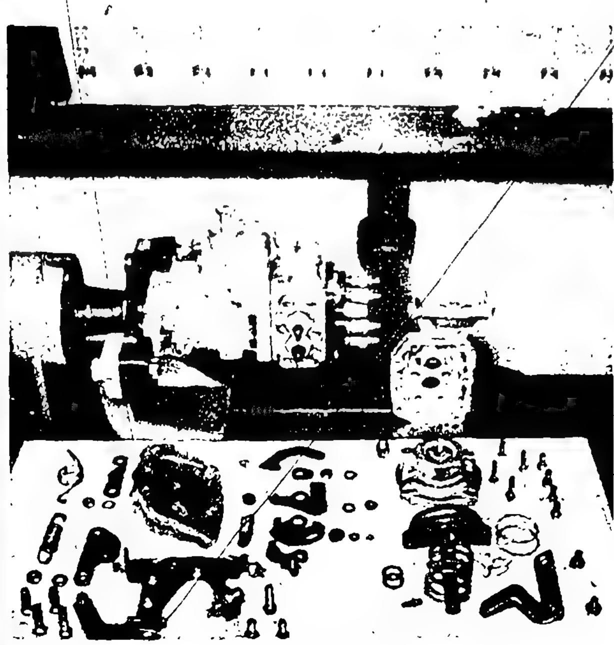
30

Additional components: to make the basic setting of the charge pressure-responsive full-load stop, use either commercially available vernier height gauge or test tools for gasoline injection pumps (Fig. 33, 35—37).



31

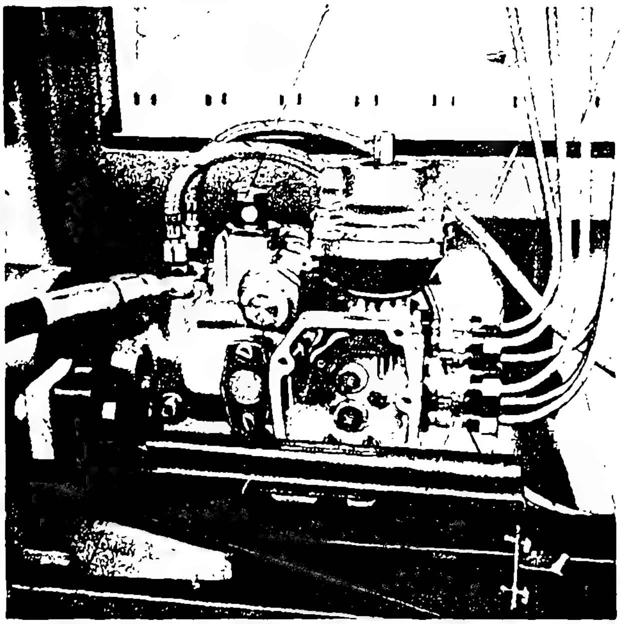
When using the gasoline injection pump tools mentioned above, make a measuring foot as shown in Fig. 31.



32

6.1 **Mount manifold-pressure compensator housing, diaphragm assembly components and cam lever.**

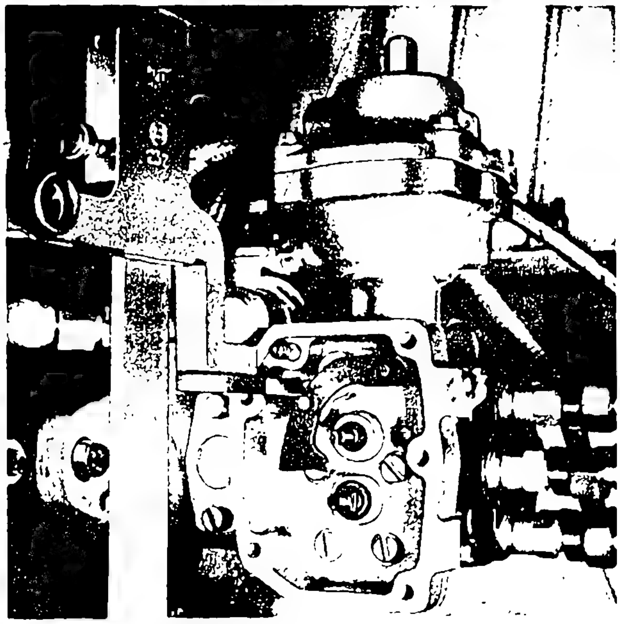
30 19



33

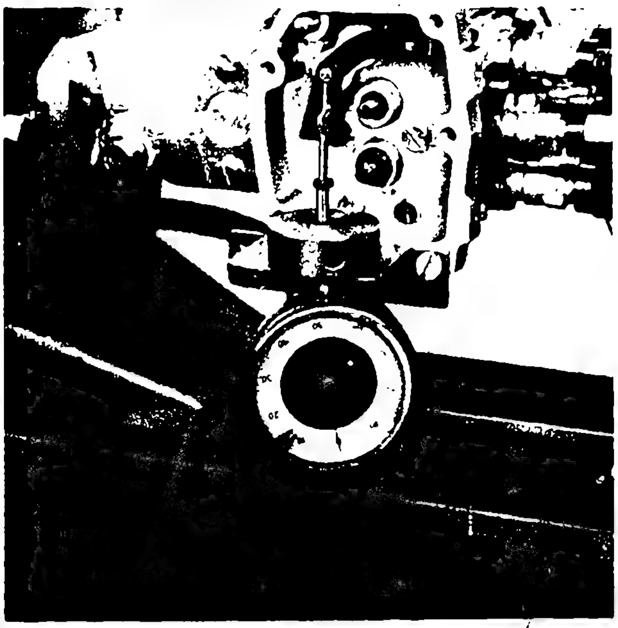
6.2 Connect lines and check in accordance with sections 4.1—4.2.

Fit support plate EFEP 455/0/1 horizontally.



34

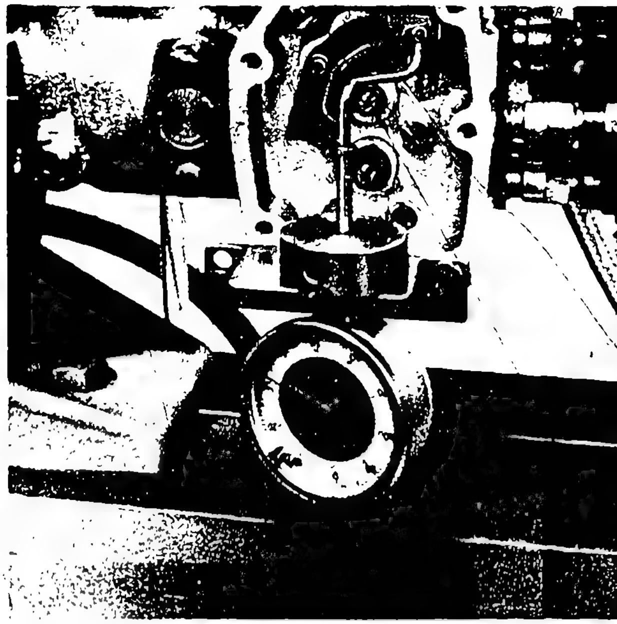
Instead of the gasoline injection pump test tools enumerated here, it is also possible to use a commercially available vernier height gauge.



35

Fit dial indicator EFAW 63 with holder EFEP 414/2 and measuring foot as shown in Fig. 31.
Bring measuring foot into contact with bearing pivot on cam plate. Preload dial indicator to basic setting dimension with 0 charge pressure (e. g. 11.5 mm).

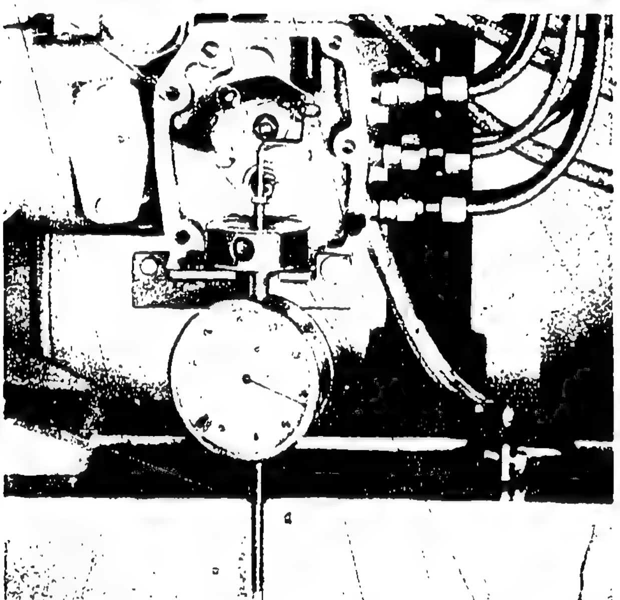
3220



36

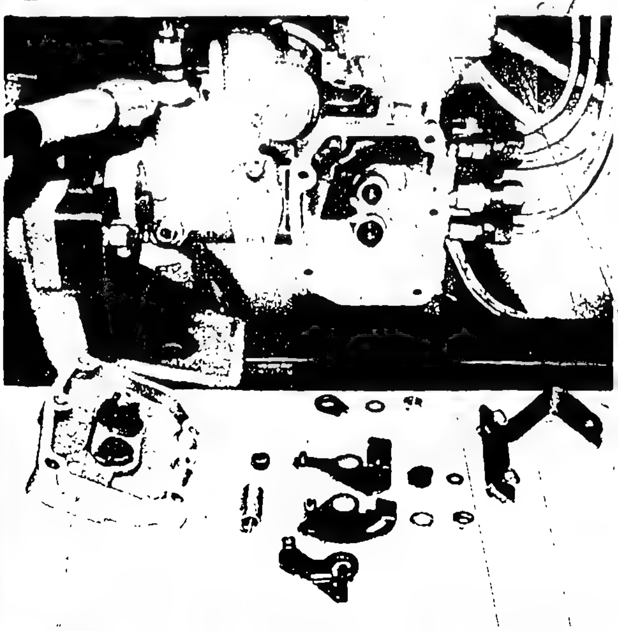
Reposition measuring assembly, bring foot into contact with adjusting pin. The dial indicator should show 0, correct with screw, Item 12 Fig. 29 and secure with lock nut.

Note: The items appearing in the subsequent text are shown in Fig. 29!



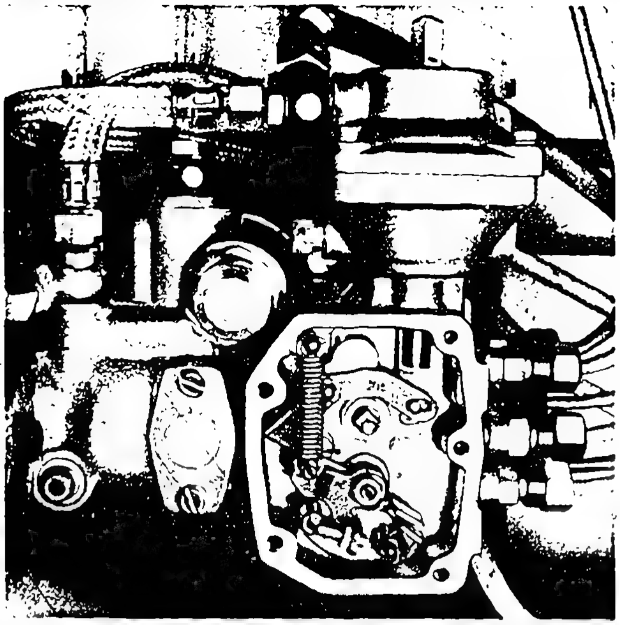
37

Connect compressed air supply with inlet union EFEP 179/2 and inlet union screw as well as 0—2.5 kgf/cm² (0—35.6 psi) pressure gauge to diaphragm housing. Check displacement travel under maximum charge pressure (e. g. 16 mm). Correct with shims, Item 4. Set spring preload (displacement start and end) by means of shims, Item 3.



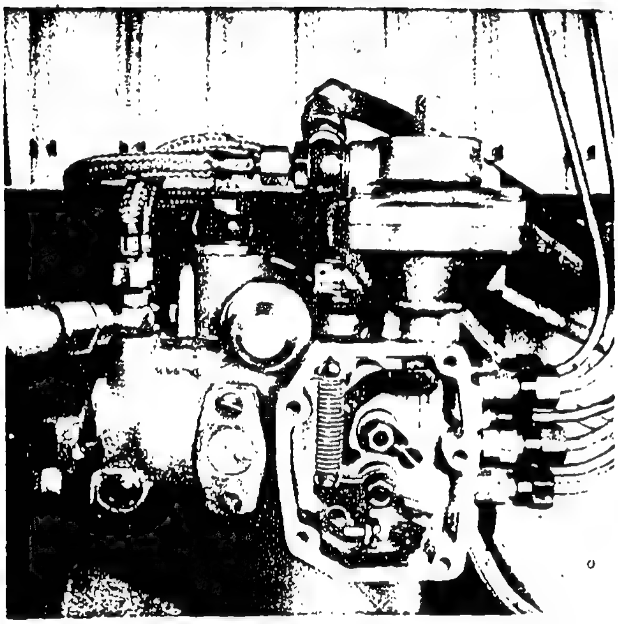
38

Fit internal delivery-rate control levers:
Insert items 24, 25, 27 with roller and ratchet plate as well as spacer and lock washer, hook tension spring into position.
Note fitting range for driver on delivery-rate control lever. The fitting range is in the direction of shut-off relative to the vertical (e. g. 10—50°).



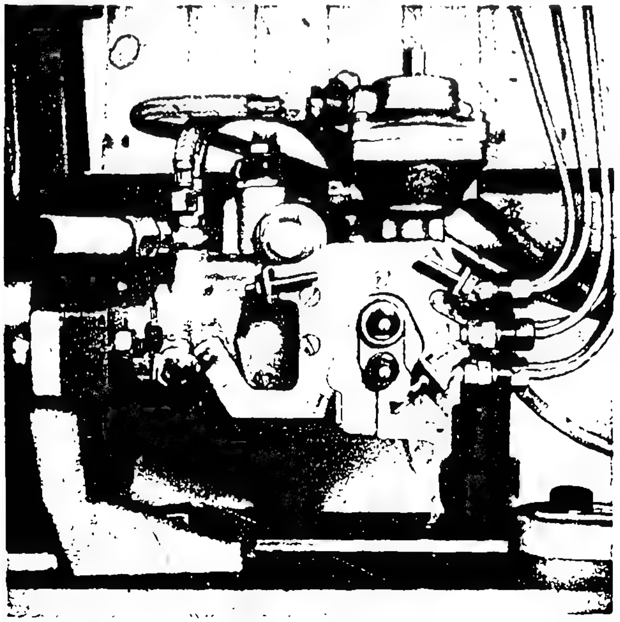
39

Correct full-load quantities (with charge pressure) according to test specification sheet by means of setting screw, Item 31 Ratchet plate in center position during this adjustment.



40

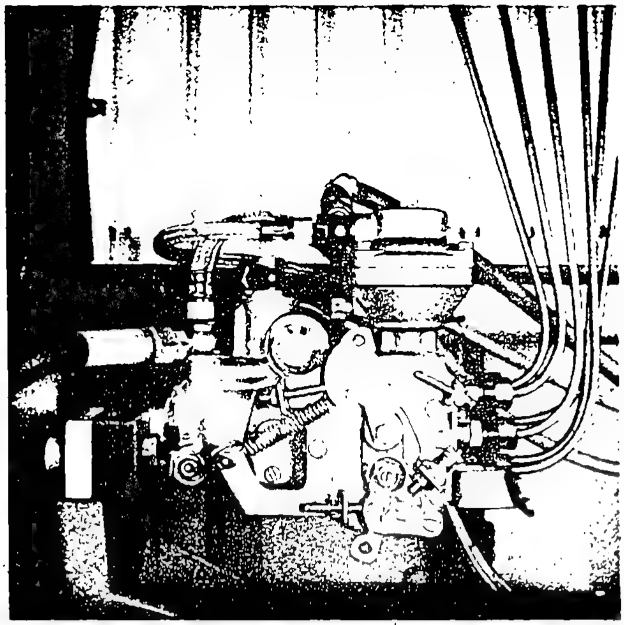
Set low idle on throttle shaft square head.
Fit driver, Item 21, at an angle to suit idling position (e. g. 0–15°).
The idling position angle is the deviation of the driver slot towards bottom right relative to the horizontal.



41

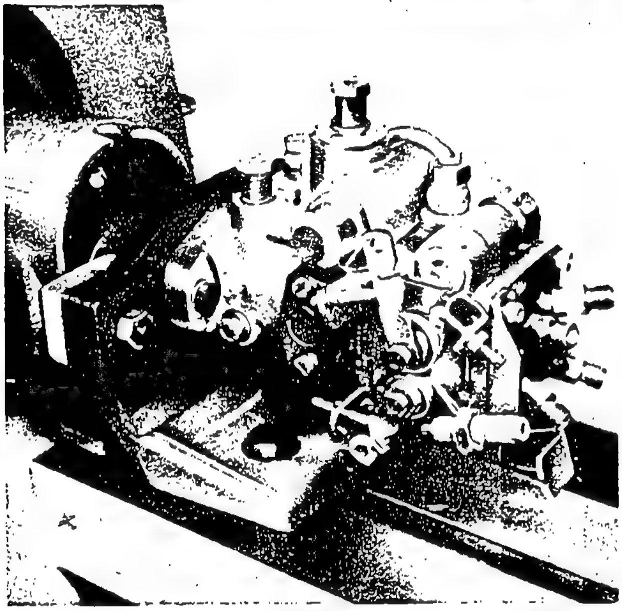
6.3 Fit cover with stop plate:
Here, the driver of the outer throttle shaft must engage in the slot of the inner driver and the driver of the outer spill-piston shaft must be in contact with strap, Item 24.

36 22



42

Fit external control levers:
Fit speed control lever (center punch marking?) at angle α in idling position and bring into contact with idling stop screw.
Correct low idle with stop screw in accordance with test specification sheet 1.4.
Set break-away on stop screw in accordance with test specification sheet 1.6.
Bring outer spill-piston shaft into contact with inner stop (of shut-off). — Set maximum charge pressure.
Fit delivery-rate control lever (center punch marking?) at angle γ.
Set external stop screw to 1 mm clearance relative to delivery-rate control lever with torsion spring unhooked. Hook torsion spring into position.
Adjust start and shut-off stop, see Fig. 29.



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7. FINAL OPERATIONS

Unclamp pump: Secure delivery-valve holder when releasing fuel-injection tubings to ensure that the delivery-valve holder does not slacken (do not exceed 4—4.5 kgf/m tightening torque).

Sealing: All screw plugs should be sealed with sealing lacquer. Stop screws on stop plate should be either sealed with lacquer or with wire and lead seals whenever service work is carried out.

BOSCH Technische Mitteilung

Kenntnis genommen:	Bearbeiter	Inhaber	Meister	Mechaniker
Noted by:	Project specialist	Owner	Supervisor	Mechanic

Measuring device for 0 460. . -EP/VA...C..
Distributor-type fuel injection pump

VDT-BMP 160/1002 B
Edition 3.1974
Translation of German edition of 27.2.1974

EP 46

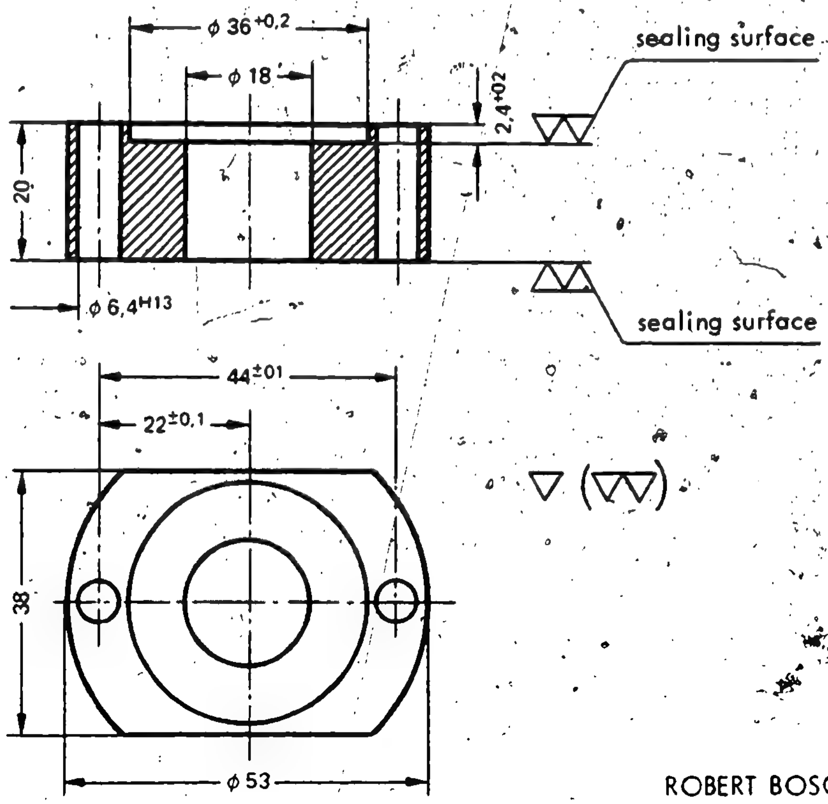
To: AV/S

For functional reasons the timing device piston has been modified. An intermediate flange between the fuel injection pump and the measuring device is necessary so that the measuring device 1 688 130 121 (formerly KDEP 1025) can continue to be used for measuring the timing device travel. This intermediate flange can be manufactured locally according to Fig. 1 or ordered from your local representative. The Part Number will be announced in "WA-Information".

2 screws M 6 x 35 mm (2 910 141 207) are required for fastening. Also the seal ring 1 460 206 007 is needed for sealing between the measuring device and the intermediate flange. In future the measuring device 1 688 130 121 will be delivered complete with intermediate flange.

In case of inquiry, please contact your authorized representative.

Aluminum



ROBERT BOSCH GMBH
Geschäftsbereich K-Ausrüstung
Handel
Kundendienstschule

Fig. 1

Change in gasket for delivery-valve assembly

As from FD 930, all distributor-type fuel-injection pumps type VA..C.. will be equipped with bronze gaskets 1 460 105 302 (Item 83 in the Service Parts List) instead of the copper gaskets used previously.

For all distributor-type fuel-injection pumps type VA..C.. with bronze gaskets, the tightening torque of the delivery-valve holder is increased from 35 ... 45 Nm to 45 ... 55 Nm.

Bronze gaskets can be fitted during repairs on VA..C.. distributor pumps having an older FD.

It is to be noted that only gaskets of the same material are to be used on the same hydraulic head. The delivery-valve holders must be tightened with the appropriate torque.

Note

The copper gaskets will continue to be fitted on distributor pumps type VA.. up to and including the B-version, and the tightening torque of 35 ... 45 Nm will be retained for the delivery-valve holder.

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EP/VA..C.. 0 460 3..

List of service parts for

automatic excess-fuel starting device

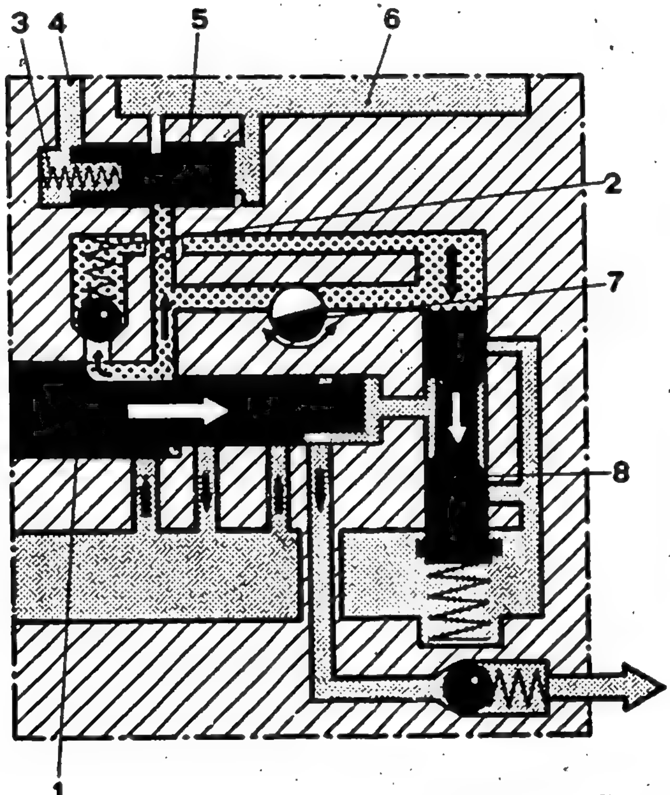
VDT-I-460/118 En

6.1980

Designation	Pump model	Part number	Dimension group	Diameter
Sealing plug	All models	1 463 218 015	Normal	7,025-0,005
		016		7,031- "
		017		7,037- "
		018	Overdimension	7,125- "
		019		7,131- "
		020		7,137- "
Slotted spring pin	All models	1 460 310 001		
Helical spring	EP/VA 3...193 EP/VA 4...136, 136-1 136-2, 144, 164, 175, 176, 177 EP/VA 6...124, 124-3, 124-4, 124-5, 181, 181-1, 181-2, 181-3, 181-4, 182, 185, 185-1, 185-2, 201	1 464 626 018		
Helical spring	EP/VA 2...156, 162 EP/VA 3...134-2, 134-3, 134-4, 143, 152, 172 EP/VA 4...118, 118-1 118-2, 118-3, 118-4 141, 141-1, 141-5, 141-8, 145-1, 165, 170, 173, 175, 183, 186, 186-1, 197, 197-1 EP/VA 6...119, 119-1 151, 151-1, 151-2, 153, 160, 160-1, 166, 167, 168, 168-1, 169, 178, 178-1, 186-1	1 464 626 019		

Designation	Pump model	Part number
Helical spring	EP/VA 6...150, 179	1 464 626 021
Helical spring	EP/VA 4...128, 141-3, 141-7, 171	1 464 626 022
Helical spring	EP/VA 4...180-4, 187, 188, 188-1, 190 EP/VA 6...180, 180-1, 180-2, 180-3, 189, 191, 191-1, 195, 196, 198, 199, 401, 402, 403	1 464 626 045

Functional description:
In VA pumps with normal automatic starting fuel delivery the fuel of the control circuit is pumped directly to the pump interior (6) via the starting valve (5).



1 = Distributor-pump plunger
2 = Non-return valve
3 = Starting spring
4 = Suction side of supply pump
5 = Starting valve
6 = Pump interior
7 = Control throttle
8 = Control collar

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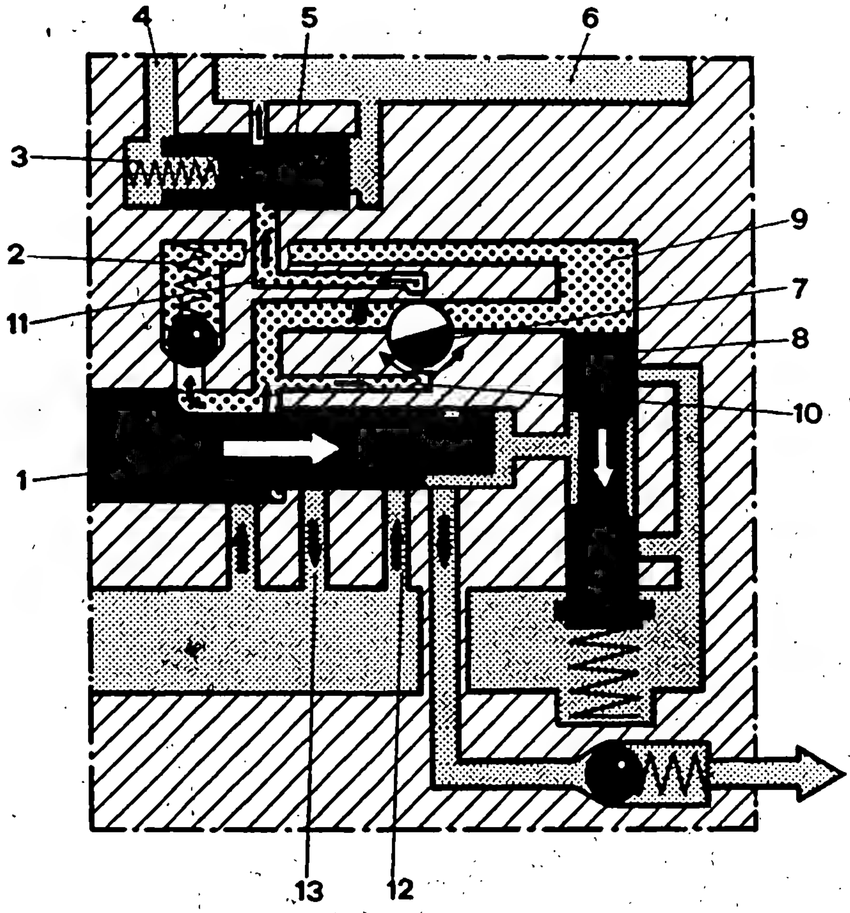
In the case of pumps with throttle-controlled starting fuel delivery the fuel flows via an additional bore (10) via the control throttle (7) to the starting valve and to the pump interior.



1 = Distributor-pump plunger
2 = Non-return valve
3 = Starting spring
4 = Suction side of supply pump
5 = Starting valve
6 = Pump interior
7 = Control throttle
8 = Control collar
9 = Control circuit
10 = Additional bore
11 = Inlet bore to starting plunger
12 = Spill port to control circuit
13 = High-pressure circuit inlet port

With the control throttle (7) in the maximum-speed position, this bore (10) of the control circuit is additionally connected to the inlet port to the distributor-pump plunger (1) via a transverse groove in the control throttle (7). The fuel of the control circuit (9) can thus flow back into the pump interior via the control throttle (7) and the distributor-pump plunger (1).
The starting fuel delivery is shut off (transition from starting to full load) as usual by the pump interior pressure.

In the idle position, the connection of the additional bore (10) in the control circuit to the distributor-pump plunger (1) is interrupted.

There is thus no starting fuel delivery.

Note on testing:
When testing the starting fuel delivery, the speed-control lever must be up against the maximum-speed stop.

Please direct questions and comments concerning
the contents to our authorized representative
in your country.

BOSCH

REPAIR INSTRUCTIONS
46
VDT-WJP 161/4 B
Ed. 1

Distributor-type fuel injection pump 0 460 . .

EP/VA . . H . . C . .

D9

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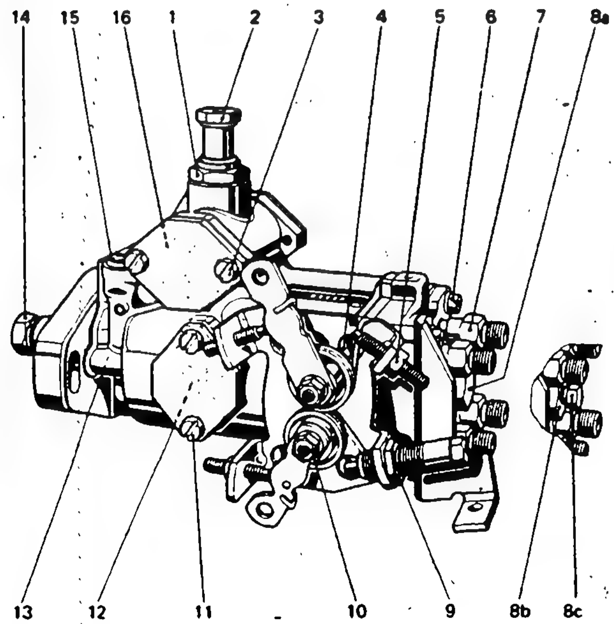
11	3. Testing the component parts
12	4. Repairing the hydraulic head
16	5. Assembly
26	6. Setting the pre-stroke
30	7. Auxiliary tools

WJP 16114

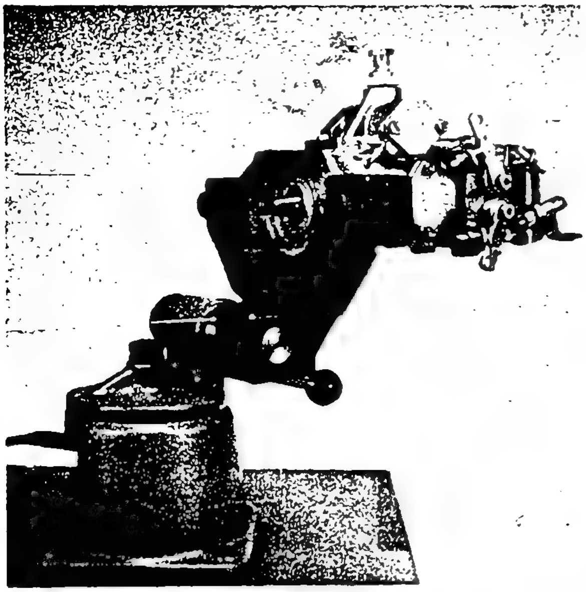
1. Tools and tightening torques

Tool	Part Number Part Marking	Type	Use, Remarks
Universal clamping bracket	KDEP 2963	–	For clamping pump
Flange	1 685 720 062	EFEP 157/B	during disassembly and assembly.
Assembling sleeve	KDEP 2936	–	For protecting the O-ring while fitting on the governor-control piston shaft.
Assembling sleeve	KDEP 2937	–	For protecting the O-ring while fitting on the throttle shaft.
Extractor hook	KDEP 2938	–	For removing the seals under the delivery valves in the hydraulic head.
Assembling sleeve	KDEP 2939	–	For protecting the radial seal during installation of the drive shaft.
Spacer sleeve	KDEP 2935	–	For adjusting the timing piston spring initial tension.
Measuring device	KDEP 2931	–	For setting prestroke
with Extension	KDEP 2931/1	–	For M 12 x 1 threads (piston dia. 8, 9 and 10 mm/0.315, 0.354 and 0.394 in).
Extension	KDEP 2931/2	–	For M 14.5 x 2 threads (piston dia. 11 and 12 mm/0.433 and 0.472 in).
Lapping mandrel	KDEP 1020	–	
Puller	KDEP 1021	–	
Testing device	KDEP 1022	–	For repairing the hydraulic head.
Measuring device	KDEP 1023	–	
Spring tester	KDEP 1024	–	
Lapping paste	5 837 010 105	Ft 26 v 14	50 g (1 3/4 oz) tin
	150		500 g (1.1 lb) tin
Lapping paste	5 837 011 105	Ft 26 v 16	50 g (1 3/4 oz) tin
	150		500 g (1.1 lb) tin



Tightening torques in kgf.m (lbf.ft)

		kgf.m	lbf.ft
1	Overflow valve M 20 x 1	4 - 6	(28.9 - 43.4)
2	Inlet union screw M 12 x 1.5	2 - 2.5	(14.5 - 18.1)
3	Slotted cheese-head screw M 6	0.5 - 0.6	(3.6 - 4.3)
4	Countersunk flat bolt	0.5 - 0.9	(3.6 - 6.5)
5	Hex. nut M 6	0.5 - 0.6	(3.6 - 4.3)
6	Slotted cheese-head screw M 6	1.1 - 1.3	(8.0 - 9.4)
7	Delivery valve holder M 14 x 1.5	4.0 - 4.5	(28.9 - 32.5)
8a	Screw plug M 12 x 1 for piston dia. 8, 9, 10 mm	4 - 6	(28.9 - 43.4)
8b	Screw plug M 14.5 x 2 for piston dia. 11 and 12 mm	6 - 7	(43.4 - 50.6)
8c	Hexagonal screw M 6	0.4 - 0.5	(2.9 - 3.6)
9	Hex. nut M 12 x 1	1.4 - 1.8	(10.1 - 13.0)
10	Hex. nut M 6	0.5 - 0.7	(3.6 - 5.1)
11	Slotted cheese-head screw, or Hex. screw, M 6	0.5 - 0.6	(3.6 - 4.3)
12	Slotted cheese-head screw, or Hex. screw, M 6 (for securing timing pointer)	0.2 - 0.3	(1.5 - 2.2)
13	Countersunk flat bolt M 5 (vane-type pump)	0.4 - 0.55	(2.9 - 4.0)
14	Hex. nut M 12	6 - 7	(43.4 - 50.6)
15	Threaded insert M 12 x 1.5 (fuel inlet)	4 - 4.5	(28.9 - 32.5)
16	Pressure regulating valve M 14 x 1	0.8 - 0.9	(5.8 - 6.5)



1

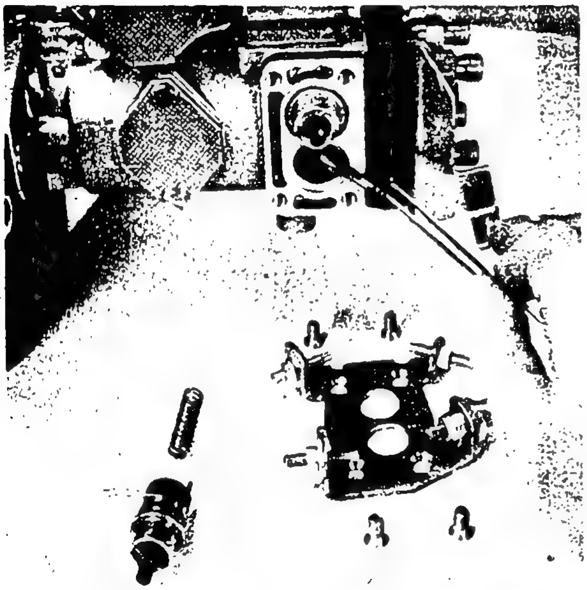
We recommend that an initial inspection be carried out on the test bench before disassembly of the distributor-type fuel injection pump.

Such a procedure will aid in determining the extent of repairs that must be undertaken, for example, whether repairs are necessary to the hydraulic head.

2. Disassembly

Remove coupling.
Clamp the pump with the clamping bracket and appropriate flange to the clamping support.

Dismantle the delivery rate control lever (governor-control piston operation for delivery rate control) and speed control lever (throttle operation for speed control).
Remove washer from under delivery rate control lever, and torsion springs.



2

Remove stop plate.

Remove shaft and bushing of delivery rate control device and governor-control piston spring.

Take out governor-control piston.

3

Disassemble shaft and bushing. To do this place the threaded end of the shaft on the workbench and press down on the bushing.

Note:
Do not lose the washer between the bushing and shaft.

Remove O-rings from shaft and bushing.

Take out shaft and bushing of speed control device, and throttle with accompanying spacer ring.

Attention:

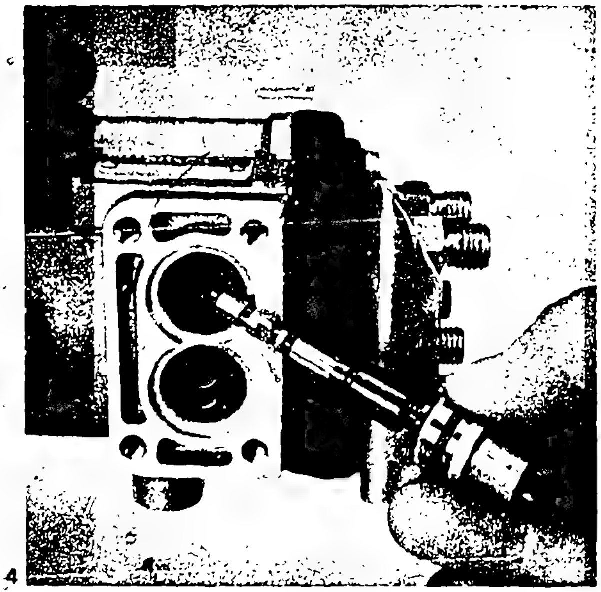
The throttle and spacer ring have been matched to the hydraulic head during production. The throttle, therefore, must only be installed along with its accompanying ring. Do not lose the spacer ring.

Throttle fitting for EP/VA..H..C.. differs according to pump model.

1. Jaw fitting: such as the throttle fitting on EP/VA..H..B..

2. Pin fitting: such as the governor-control piston fitting

3. Collar fitting: first introduced on some models of distributor-type pumps EP/VA..H..C.. Therefore, only the latter fitting method will be discussed in these instructions.

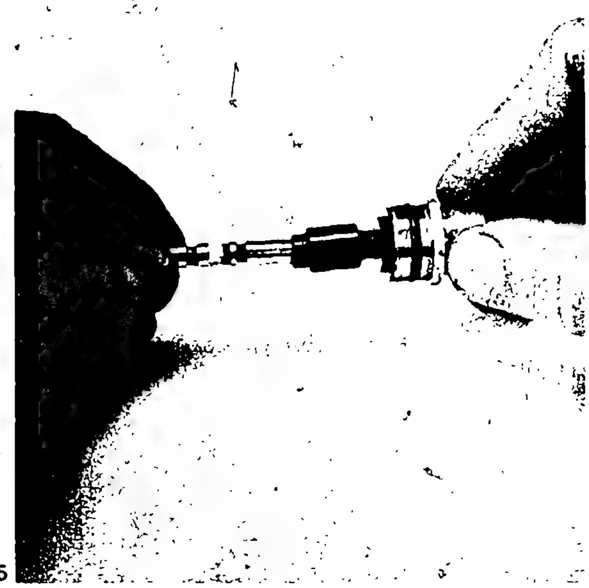

4

For collar fitting, separate the throttle from the bushing and shaft.

Place the threaded end of the shaft on the bench and disassemble shaft and bushing by pressing down on the bushing.

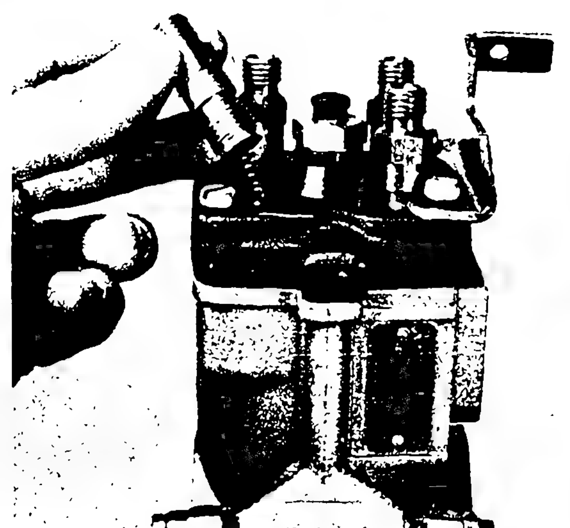
Note:

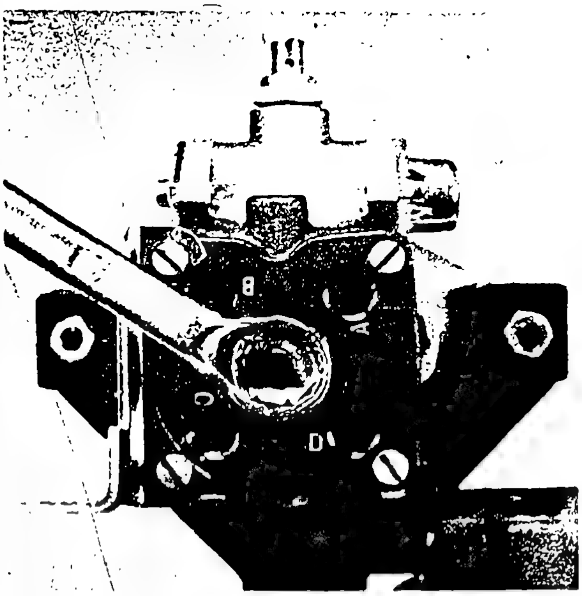
Do not lose the washer between the bushing and shaft. Remove O-rings from shaft and bushing.


5

Remove delivery valve holders, springs, washers and fillers as well as delivery valves. The hydraulic head ports are lettered A, B, etc. Lay out delivery valve holders, springs, valves, etc. according to these letters so that they can be reinstalled in the same ports.

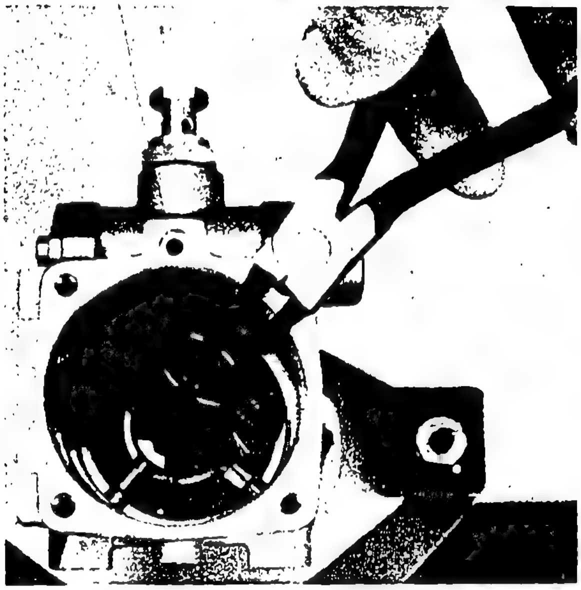
Remove the seal rings under the delivery valves with the extractor hook.


6



7

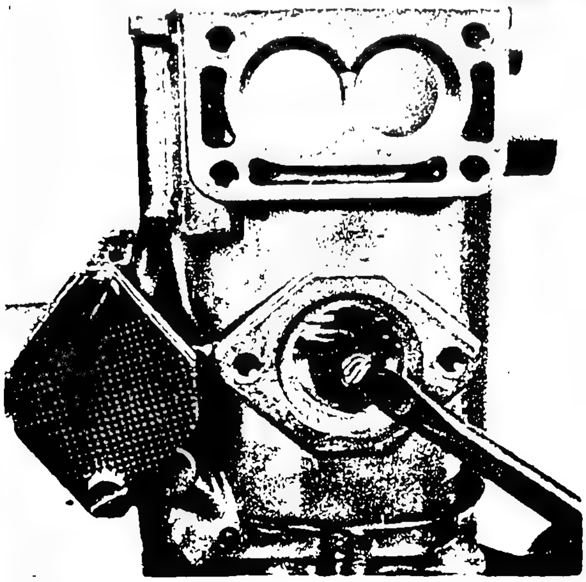
Unscrew the central screw plug. Remove the seal ring.


8

Clamp the pump vertically so that the rollers do not fall out.

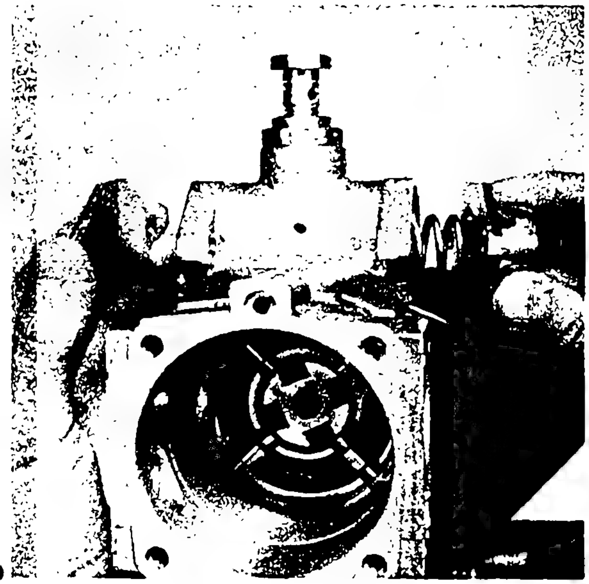
Unscrew the hydraulic head fastening screws and pull it upwards and off by hand. Remove the small seal ring between hydraulic head and pump housing.
Remove the plunger from the hydraulic head. Do not lose the washer under the plunger base and the washers under the spring seat.

Take out the cam plate.


9

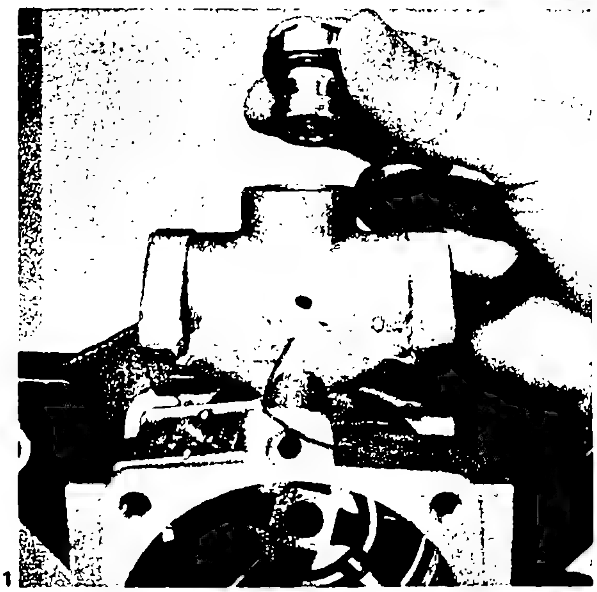
Remove the side cover, take out the seal ring and unscrew the timing pointer.

Remove the covers on both sides of the timing device.
Remove the seal rings and spring.



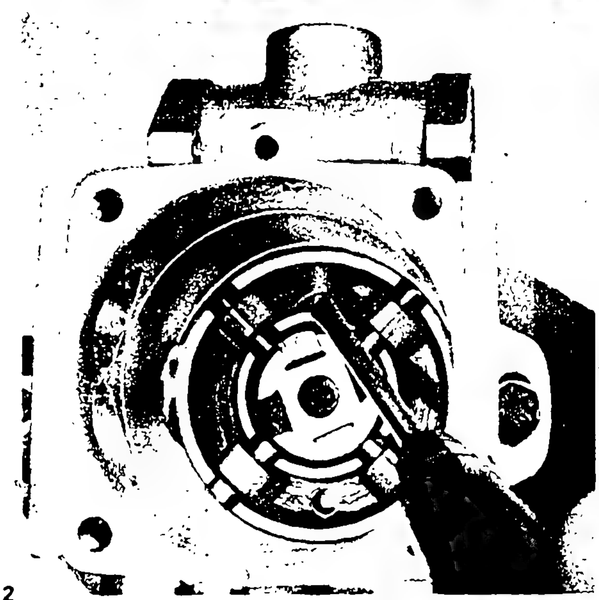
10

Take out the overflow valve.
Remove O-ring.

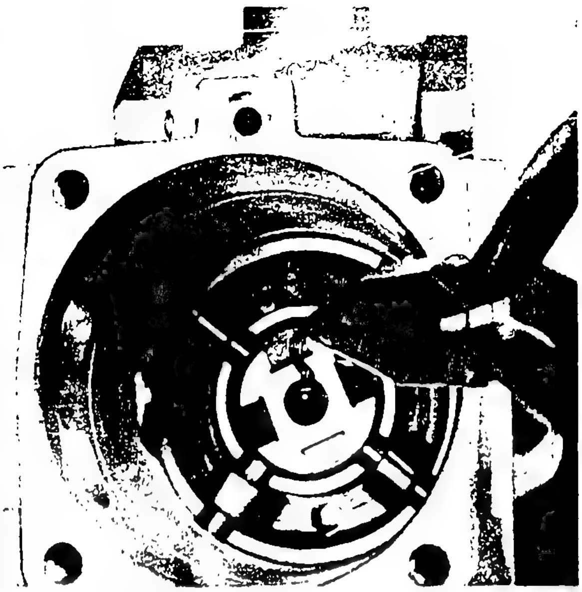


11

Lift the clip with a screwdriver.

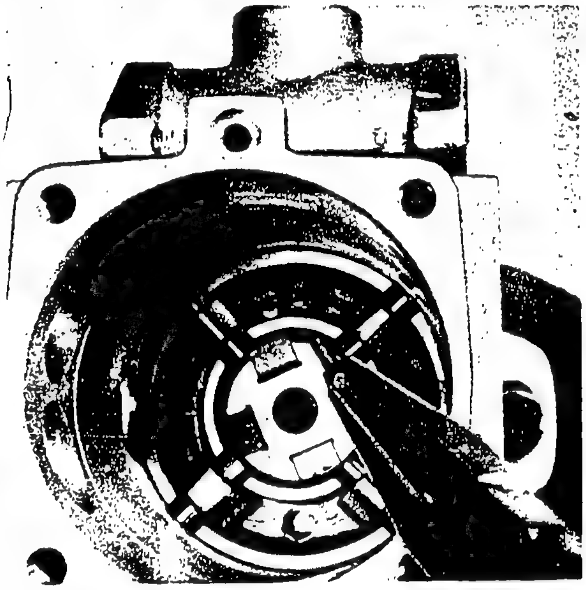


12



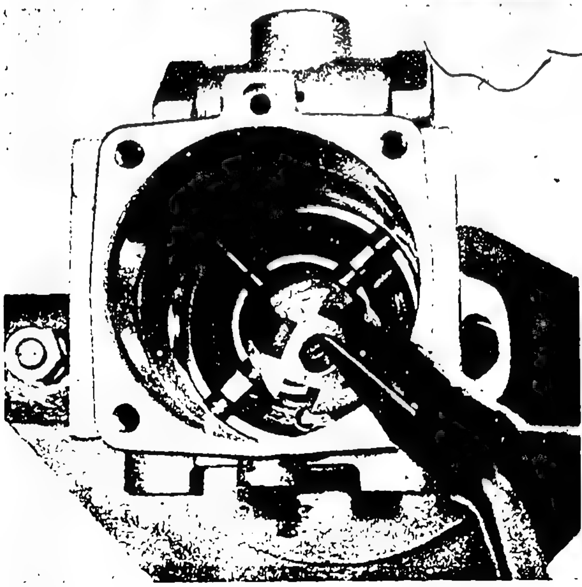
13

Grip and remove the clip with pliers.



14

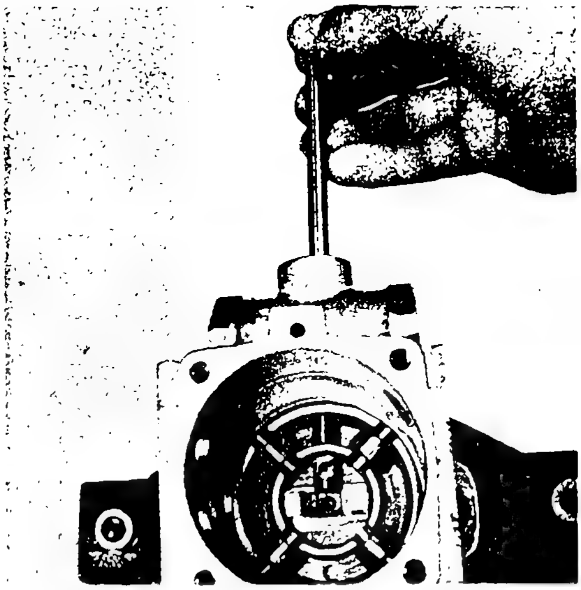
Take out the locking-pin.



15

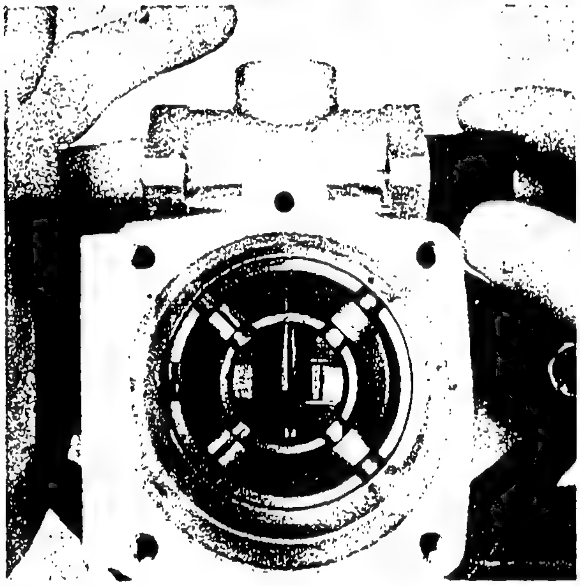
Remove the cross-type disc.

Push the connecting pin for the timing device and cam roller ring towards the center of the pump.



16

Push out the timing piston and slider.

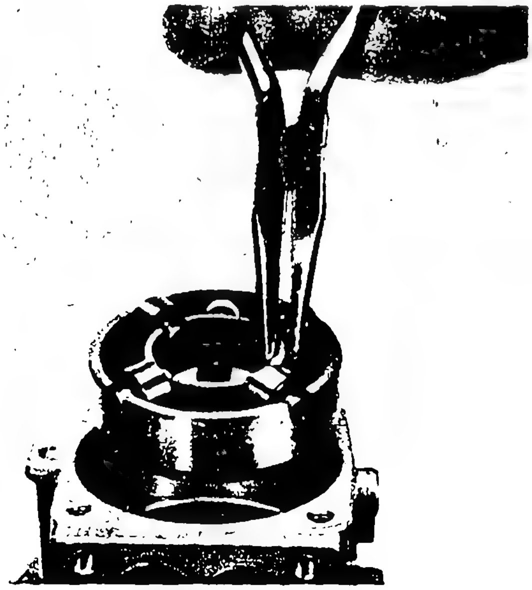


17

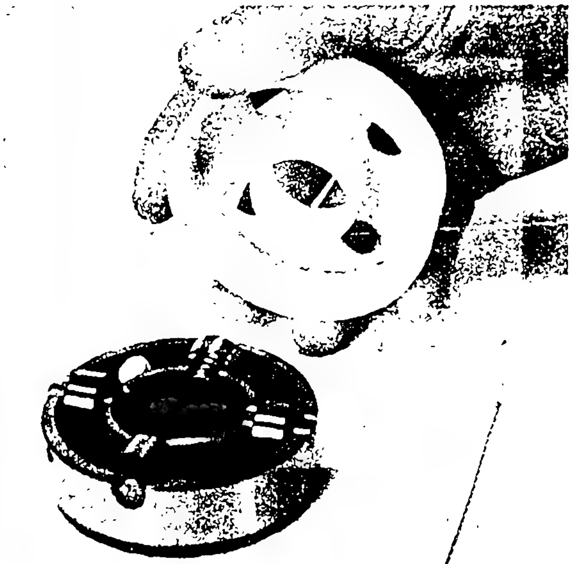
Pull the cam roller ring and connecting pin up and out.

Note:

Do not tilt the cam roller ring during removal. Do not interchange rollers.

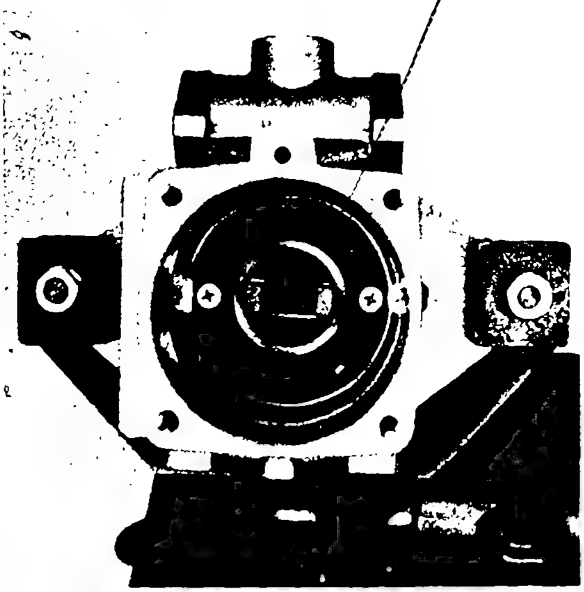


18



19

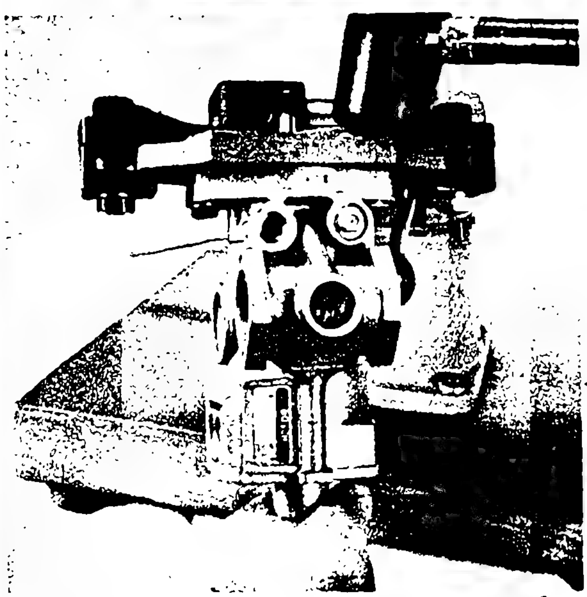
Push the connecting pin out of the cam roller ring. Place a protective cap over the cam roller ring to prevent the rollers from falling out (if necessary, manufacture according to drawing 1, page 30).



20

Remove the vane-type fuel supply pump together with the support ring and drive shaft.

To do this, unscrew both fastening screws.



21

We recommend the use of an auxiliary tool (manufacture according to drawing 2, page 30) for the following step.

Grasping the drive shaft, tilt the pump housing downwards.
Whilst constantly tapping lightly with rubber hammer pull drive shaft, together with the fuel pump and support ring out trough the bottom of the housing.

Do not tilt the support ring or eccentric race.

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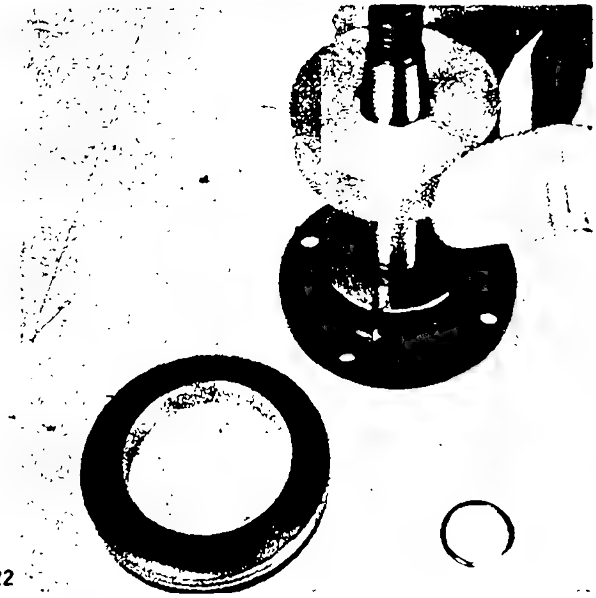
Remove the retainer.

Remove the eccentric race and place the assembly cup (manufacture according to drawing 3, page 31) over the pump impeller and vanes.

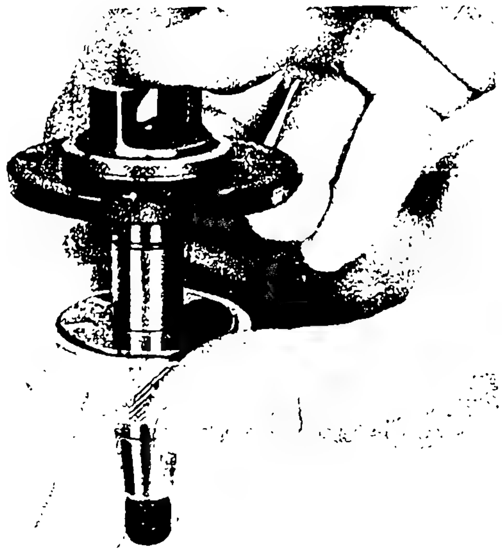


22

Invert the drive shaft.

Impeller and vanes now lie in the assembly cup.

Pull the assembly cup, Woodruf key, support ring and washer down and off of the shaft.



23

Remove the pressure regulating valve.
Remove O-rings. (Fig. 24)

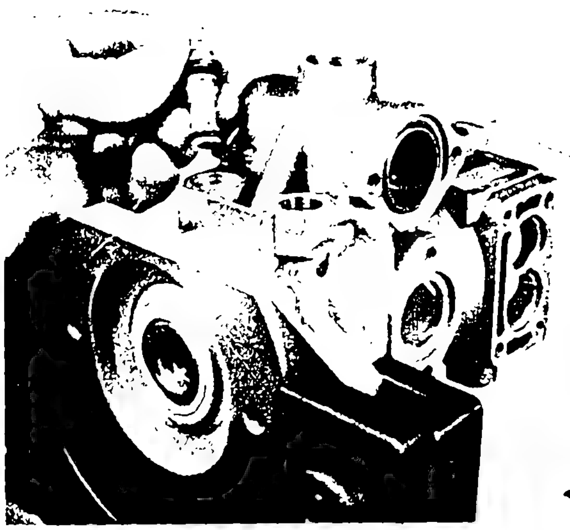
3. Testing the component parts

Clean each individual part.
Replace worn or damaged components. In doing so please note that the following parts are to be treated as one unit and must be replaced together: hydraulic head with plunger; governor-control piston and throttle; pump housing with timing piston; cam roller ring with rollers and washers; pump impeller with vanes and eccentric race.

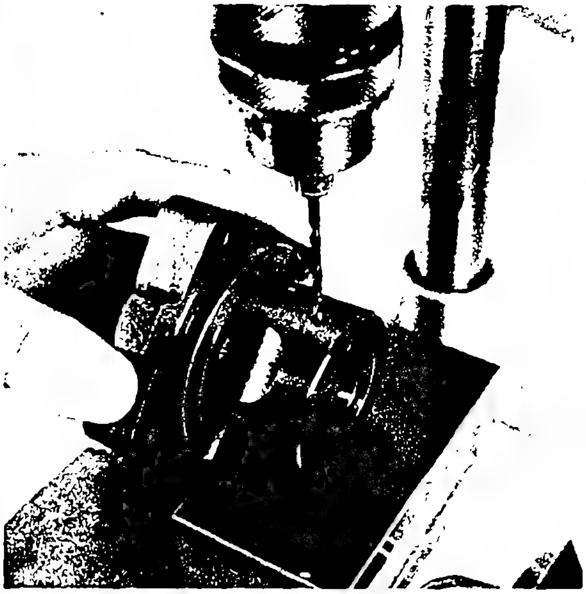
New seals must be fitted after every repair.

Prior to assembly, dip all components (including seal and O-rings) in test oil.

Carry out pump assembly and all work on the hydraulic head (subsequently described) in clean surroundings and on a clean workbench.



24



25

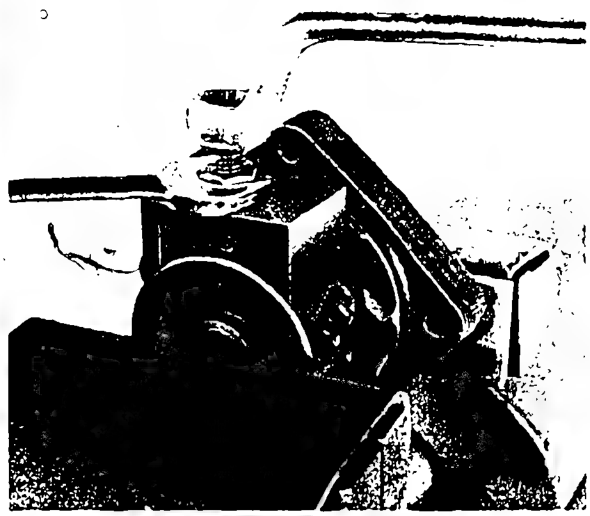
4. Repairing the hydraulic head

A leaking non-return valve (ball valve) usually causes irregular, idle and/or excessive idle speed of the engine. The prescribed idle speed is not adjustable.

If, on initial inspection, the fuel delivery at idle is incorrect (excessive) then it is to be expected that the non-return valve is leaking.

A hydraulic head with leaking non-return valve is repaired in the following way:

Drill a 3.2 mm/0.126 in dia. hole approx. 5.5 mm/0.22 in deep into the plug and tap an M 4 thread. (Fig. 25)



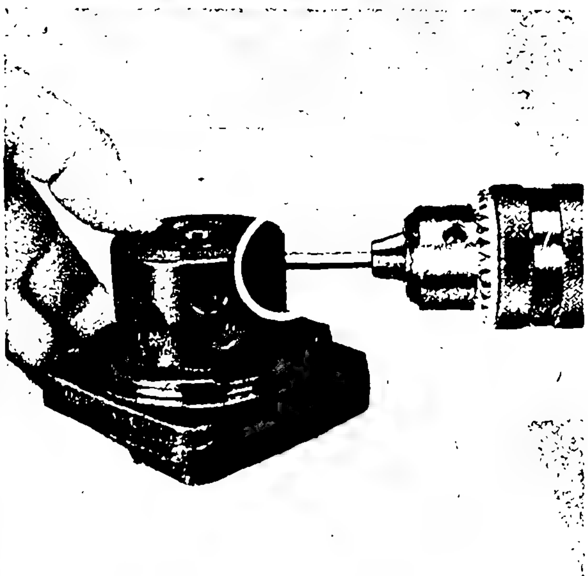
26

Using a puller remove the plug from the hydraulic head. (KDEP 1021, total length 37 mm/1.46 in, can be used if the puller support is shortened by 6 mm/0.24 in). Place the puller support on the hydraulic head, push the screw through the hole in the support, thread it into the plug and tighten slightly (only thread M 4!). Whilst holding the screw securely to prevent it turning, pull out the plug by tightening the nut.

Remove spring, spring seat and ball. (Fig. 26)

Wash and blow out the hydraulic head.

Inspect the valve seat with an illuminating magnifier. Light re-working of the valve seat can be carried out by re-lapping. Badly damaged valve seats **cannot** be re-worked and the hydraulic head must be replaced.



27

Clamp drill in clamping support. Lower the work table of the clamping support or remove it. Tighten the lapping mandrel in the drill and smear the lapping cone with rough lapping paste (Ft 26 v 16). Oil the lapping mandrel shaft.

Attention: There is to be no lapping paste on the lapping mandrel shaft.

Switch on the drill and lap the valve seat by lightly applying intermittent pressure against the lapping mandrel while at the same time rotating the hydraulic head back and forth (see Fig. 27).

Clean the lapping paste from the hydraulic head and blow it out. Re-lap with fine lapping paste (Ft 26 v 14). Visually inspect the valve seat with an illuminating magnifier.

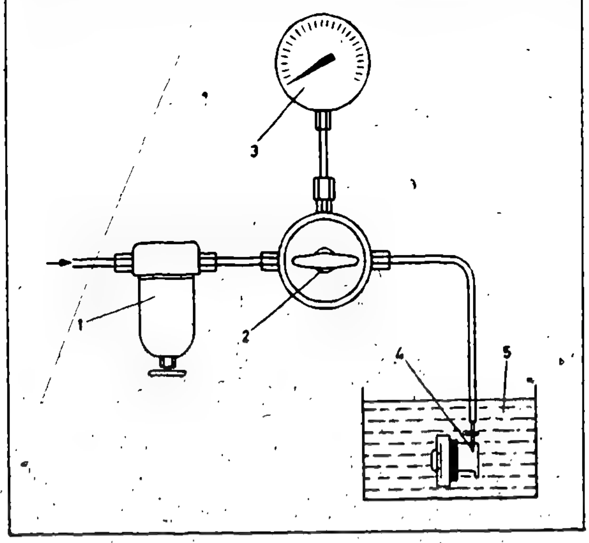
If necessary, re-lap again. (Fig. 27)

Test the valve seat for sealing. To do this, insert the testing device in the valve hole in the hydraulic head and clamp it by turning the knurled screw clockwise. Connect compressed air to the testing device through a pressure regulator.

Set the pressure to 2 kgf/cm^2 (28.5 lb/in^2) and submerge the hydraulic head in the oil bath.

No air bubbles should appear from the non-return valve port in the plunger bore.
If necessary, re-lap again. (Fig. 28)

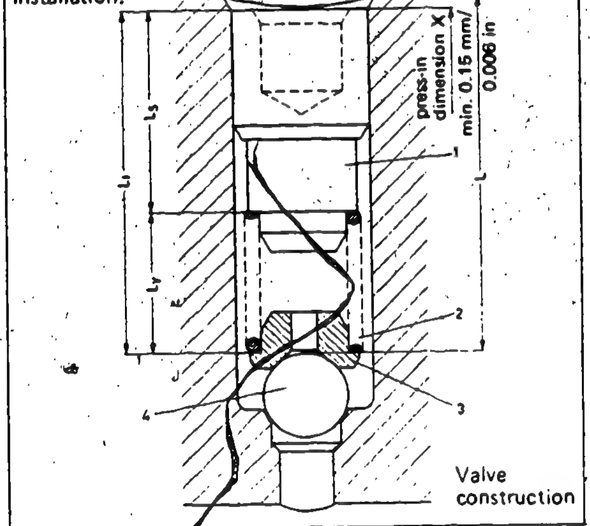
Circuit plan for seal test



28

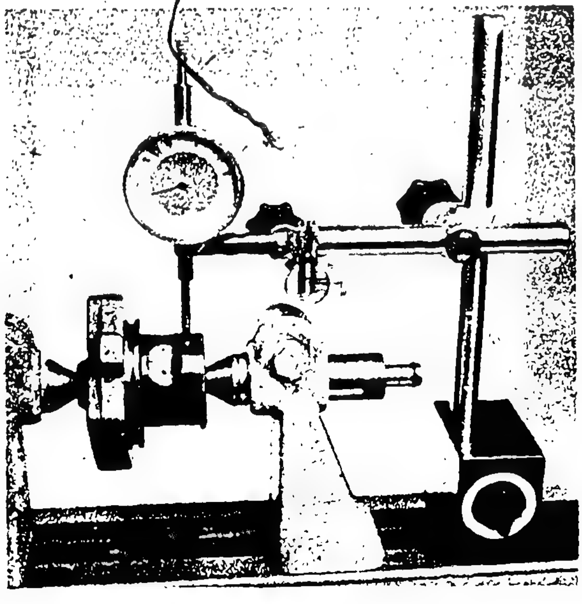
1 = water separator
2 = pressure regulator
3 = pressure gauge
4 = hydraulic head with testing device
5 = oil bath oil 61 v 11

Replacement valve; determining fitting dimensions, and installation.



29

1 = plug
2 = valve spring
3 = spring seat
4 = valve ball



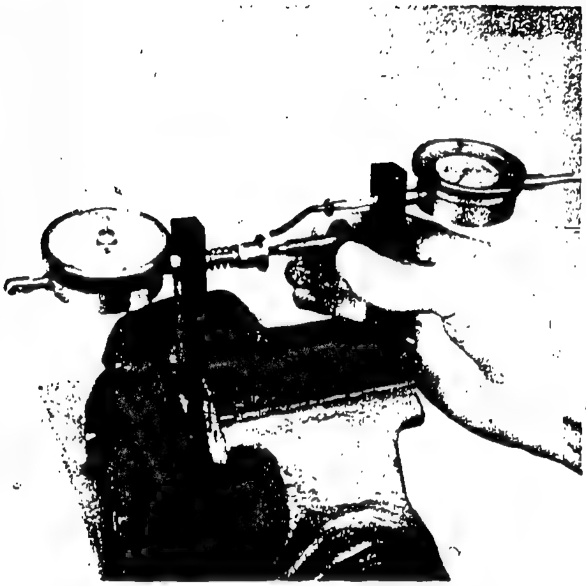
30

Replacement valve; determining fitting dimensions, and installation.

Clamp the hydraulic head in such a way that the valve bore is vertical.

Place the ball on the valve seat and determine the dimension "L" (measuring points: hydraulic head outer diameter to valve ball) with dial indicator and measuring stand.

A measuring foot must be used with the dial indicator; it must have a flat contact face which must touch the highest point of the ball. (Figs. 29 and 30)



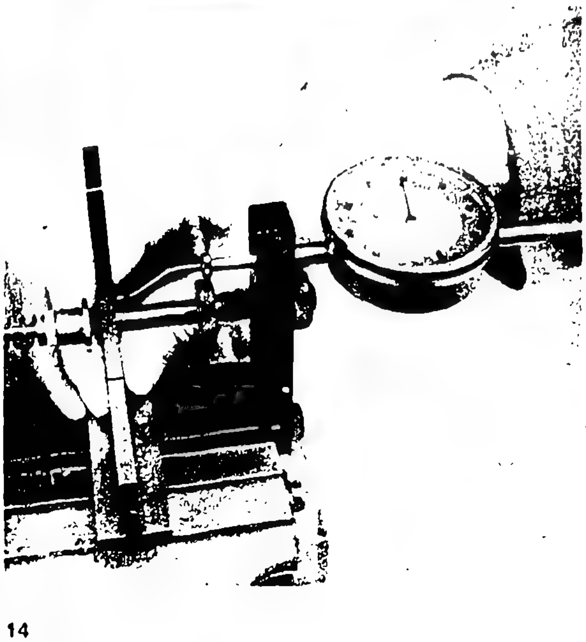
31

Clamp the measuring device with spring tester and dial indicator in a vise and determine dimension "L1". "L1" = "Lv" + "Ls" (where "Lv" = length of pre-loaded spring and "Ls" = length of plug from spring shoulder to end face), see Fig. 29.

Place the bent measuring foot of the dial indicator up against the spring tester measuring sleeve; pre-load the indicator 10 mm/0.4 in and clamp it.

Set the spring tester (unloaded) to "0". Slide the valve spring (without valve seat) on to the plug and insert it between the spring tester measuring sleeve and the adjusting pin of the measuring device (plug against adjusting pin).

Press the spring against the spring tester measuring sleeve by turning the adjusting pin until the prescribed spring pre-load Pv = 0.41 kg (0.902 pounds) is shown on the spring tester. Tighten the lock nut of the adjusting pin.



32

Now place the dial indicator measuring foot up against the measuring sleeve of the spring tester and set the indicator to "0". Remove valve spring and plug from the measuring device. In doing so, however, do not change the setting of the adjusting pin.
Place a try square against the adjusting pin and with the dial indicator measure the distance to the try square. Note dial indicator reading and list it as "L1". Dimension "X" = "L" – "L1", where "X" is the press-in depth, see Fig. 29.
Wash and blow out hydraulic head.
Lay the ball on the valve seat.
Insert the plug together with spring and spring seat and press in the plug to the depth determined (dimension "X") by using an appropriate mandrel (manufacture according to drawing 4, page 31).
Measure the press-in depth (measuring points: hydraulic head outer diameter to threaded plug upper face) using dial indicator and measuring stand.

Re-working of the KDEP 1020 lapping mandrel.

The lapping mandrel cone and shaft must be flawless. Lapping mandrels with worn shafts should be disposed of.

Lapping mandrels with worn or scored cones can be re-worked by using a nozzle reconditioning tool kit in combination with a drill and clamping support in the following manner:

Clamp the drill in the support.

Clamp the 5 mm/0.2 in dia., 20 mm/0.79 in long, guide bushing from the nozzle reconditioning tool kit in the support (with stop).

Attention:

Use only the support with stop, the support without stop has a different angle of inclination at the bevelled surfaces.

Clamp the lapping mandrel in the drill.

Place the support on the clamping support work table and adjust the height of the work table so that the lapping mandrel can be inserted into the guide bushing in the support.

Clamp the work table securely in this position.

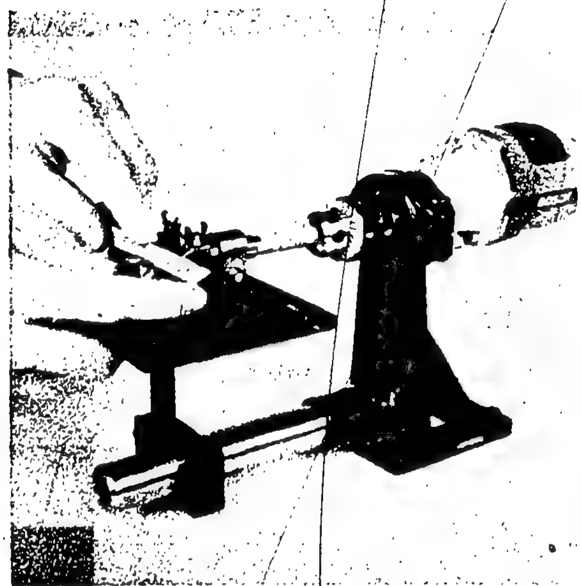
Remove the lapping mandrel and then reclamp it in the drill using the appropriate rubber coupling from the nozzle reconditioning tool kit.

Coat the lapping mandrel shaft with oil and insert it in the support guide bushing.

Switch on the drill and holding the tool kit oilstone on the bevelled surface of the support, re-work the cone of the lapping mandrel. While doing so keep the oilstone generously oiled.

After re-working, the lapping mandrel cone must be smooth and free of scores.

For care and maintenance of the oilstone refer to the manufacturer's instructions supplied with the tool kit. (Fig. 33)



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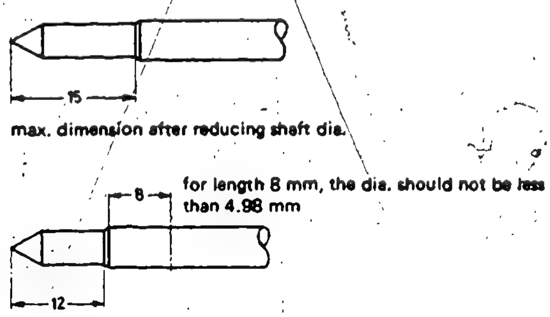


34

Re-grinding and dimensional limits of the lapping mandrel.

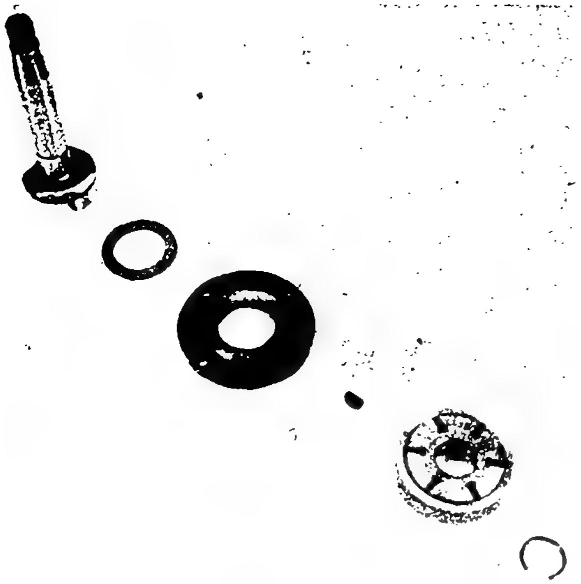
After repeated re-grinding of the cone, the shaft dia. must be reduced to 4.5 mm/0.177 in. (Fig. 34)

5. Assembly

Drive shaft and fuel supply pump

Assemble the drive shaft and supply pump in the following order: drive shaft, washer, support ring (smooth side toward the impeller), Woodruf key and impeller with vanes. Secure with retainer.

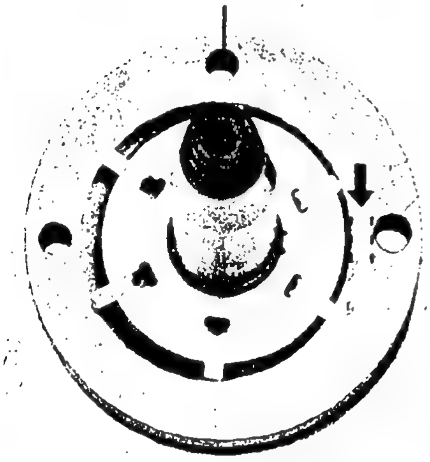
The bevel turned in the impeller must be on the retainer side.



35

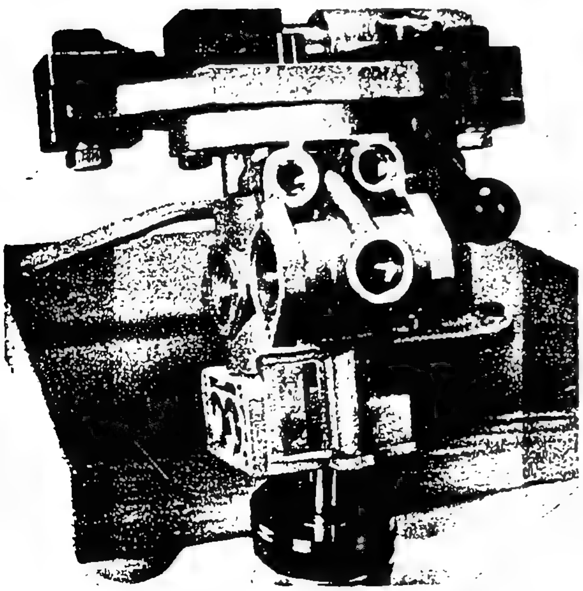
The two holes lying opposite one another in the eccentric race are located at different distances from the inner bore. When fitting the eccentric race, the hole furthest from the inner bore is to be noted (see arrow). If the direction of rotation of the pump is given as "R" (clockwise) the hole must be on the right as one looks at the threaded end of the drive shaft. With direction of rotation "L" (counterclockwise) the hole in question must be on the left.

The third hole is always on top whether clockwise or counterclockwise direction of rotation.



36

Secure the pump housing with flange and bracket in the clamping support and swivel it downwards.
In order to protect the radial seal fit the assembling sleeve on the drive shaft. Insert the drive shaft with delivery pump into the pump housing, taking care that the support ring or eccentric race are not tilted.
To do this, the auxiliary tool (manufactured according to drawing 2, page 30) is used.



Swivel the pump housing 180° upwards. While doing so hold the drive shaft secure.

Before screwing in the fastening screws ensure that all three holes in the support ring are aligned with those of the eccentric race and that the center hole points upwards toward the timing control.

37

Screw in both fastening screws.

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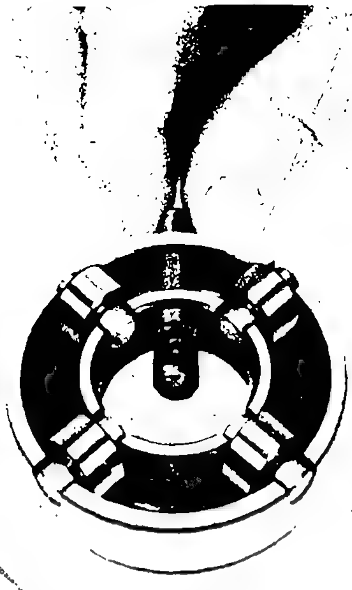
Cam roller ring

The cam ring rollers should not be allowed to fall out nor be interchanged. Should this occur, however, the roller heights must be checked again. The difference between roller heights is not to exceed 0.02 mm/0.0008 in.

When assembling the rollers, make sure that the thrust washers are located on the outside of the rollers. The conical (rounded) side of the washers must point toward the outer ring.

Insert the connecting pin:

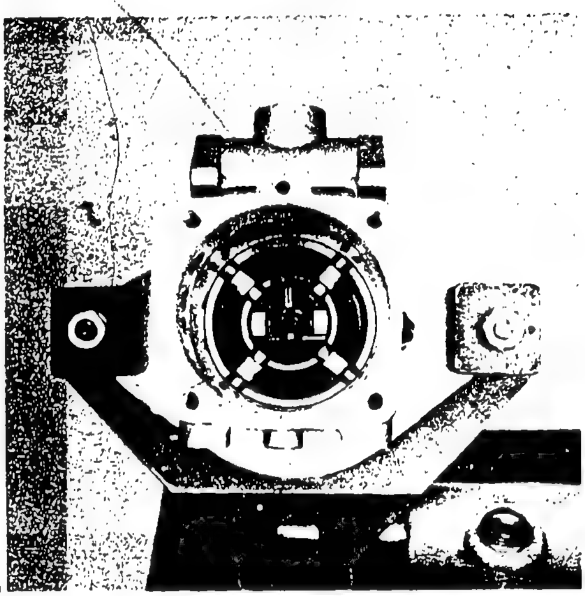
Fitting position: locking pin hole vertical. Flat surface on top and towards the cam roller ring center (see Fig. 38).



38

Install roller cam ring. Connecting pin in the direction of timing device.

Position of drive shaft:
Drive members perpendicular to connecting pin (see Fig. 39).



39

Timing device

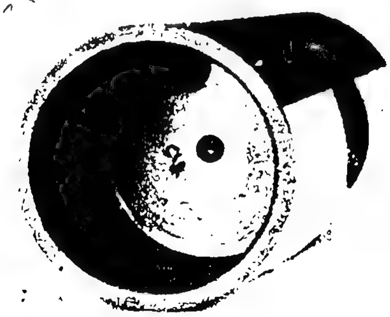
Piston fitting position:

In the opposite end of the piston to where the spring fits is a hole. Around the outside of the piston are four holes, the smallest of which must point upwards in the direction of the overflow valve.

Piston installation instructions:

For direction of rotation "R" (clockwise) spring on left.*
For direction of rotation "L" (counterclockwise) spring on right.*

*looking at threaded end of drive shaft



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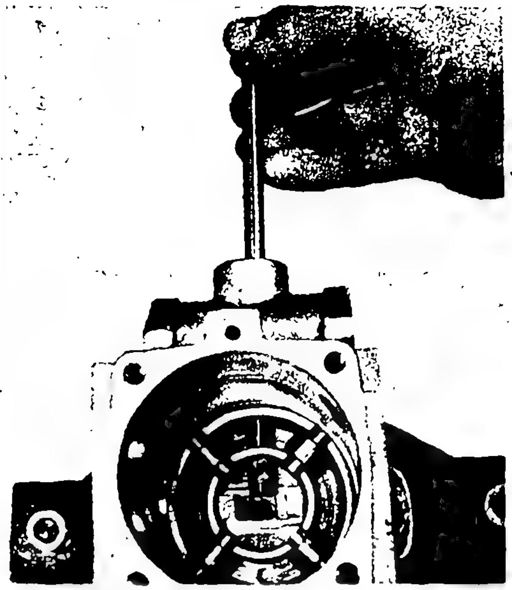
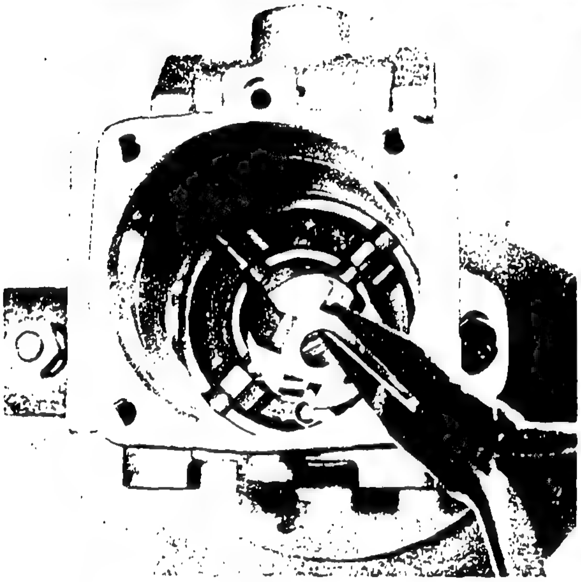


41

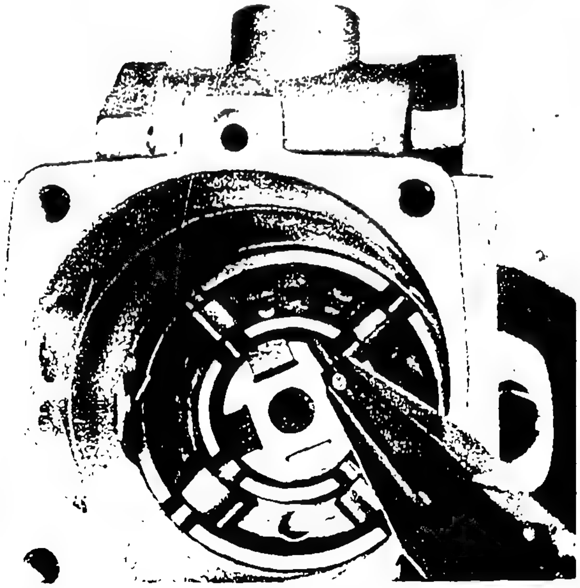
Insert timing piston and slider in the housing.

Push the cam roller ring connecting pin outwards into the hole in the slider. In doing this, it is recommended that a guide pin be made and used to center the slider hole over the connecting pin.



42

Fit the cross-type disc.



43

Secure the connecting pin with the locking pin.

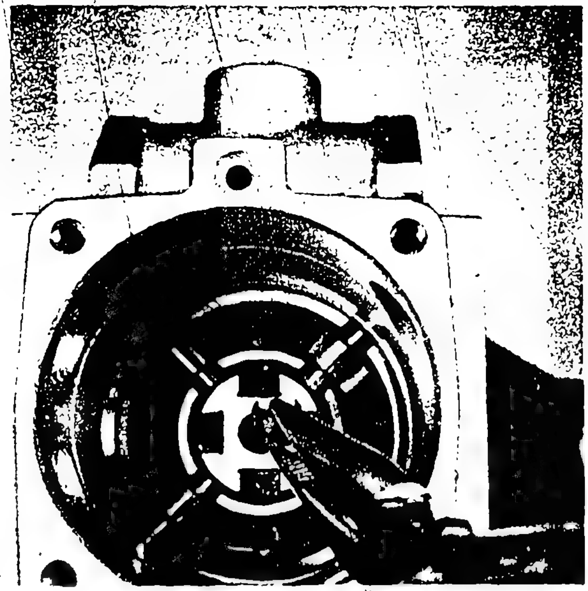
Fit the clip over the connecting pin and locking pin. (Fig. 44)

Check ease of movement of cam roller ring and timing device by pushing the timing piston back and forth.

Fit the cover on the side opposite to where the spring will be installed. Do not forget the seal.

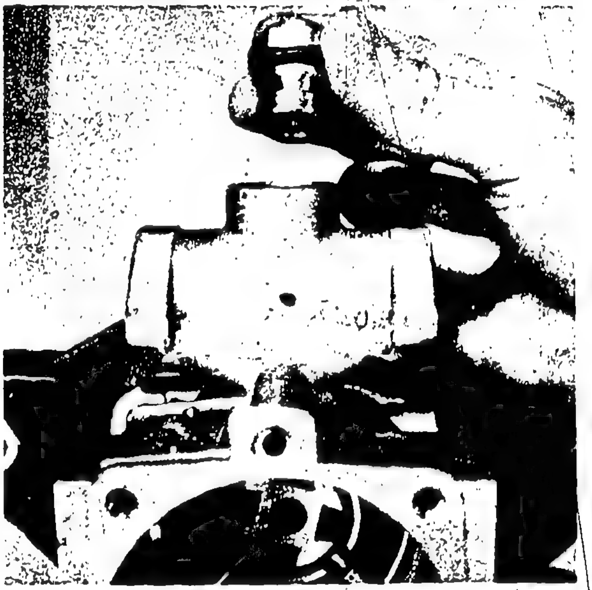
The machined side of the cover is the sealing surface.

The timing piston travel is determined by the piston length.



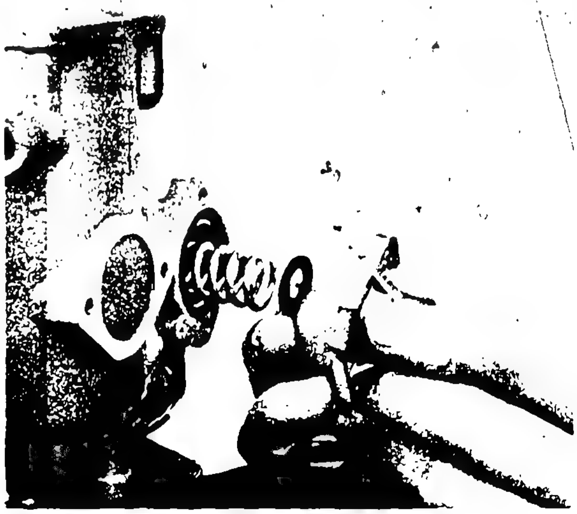
44

Install the overflow valve.



45

Put the timing device spring in place, put on the seal ring and the cover, with washers (washer thickness = dimension IV in Test Specifications Sheet).



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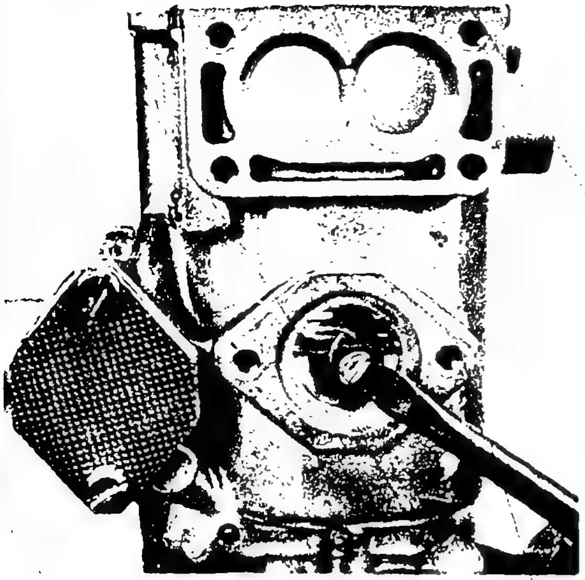
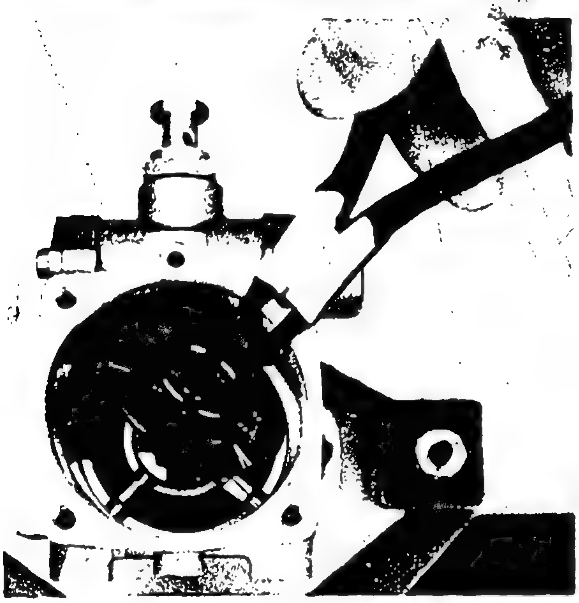


47

Secure the timing pointer on the cam roller ring with slotted cheese-head screw.

Fitting position: pointer toward the pump center.

Put seal ring in place.
Put on the cover.
Machined side of the cover is the sealing surface.



48

Insert the cam plate.

Fitting position: drive pin aligned with Woodruff key groove on the drive shaft.

49

Position the washer on the cam plate so that it will fit into the plunger base recess. The washer must remain dry, it is not to be stuck with grease or by similar means.

Place the plunger on the cam plate in such a way that the cam plate drive pin fits into the plunger base notch.

(Do not install the spring seat, spring seat washers, nor spring yet.)

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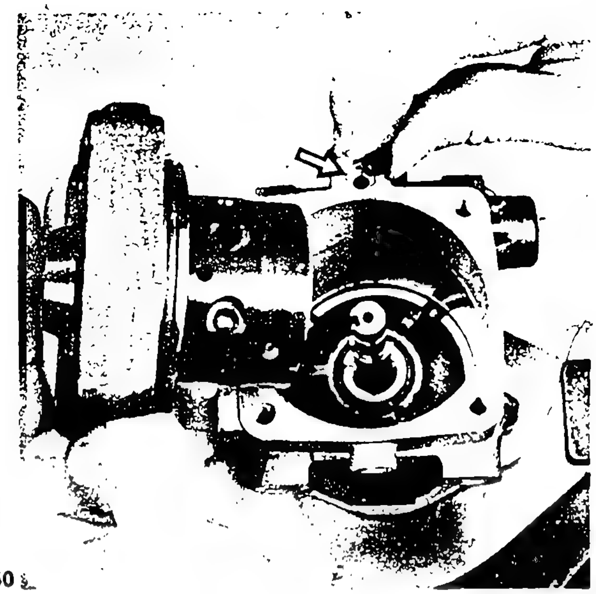
Fit the large seal ring on the hydraulic head. Lay the small seal ring over the starting quantity relief hole in the housing (arrow).

Without tipping it or damaging the seal rings, insert the hydraulic head slowly and carefully over the plunger and into the housing.

The relief bores in the housing and hydraulic head must coincide with one another.



50

To align the hydraulic head correctly with the pump housing it is recommended that the four fastening screws be tightened first. Then loosen each screw one half-turn and, using the auxiliary tool (manufactured according to drawing 5, page 31), align the hydraulic head. To do this slide the O-ring over the bushing of the delivery rate control device. Slide the bushing over the tool and insert them both in the governor-control piston port in the housing. (Fig. 51).

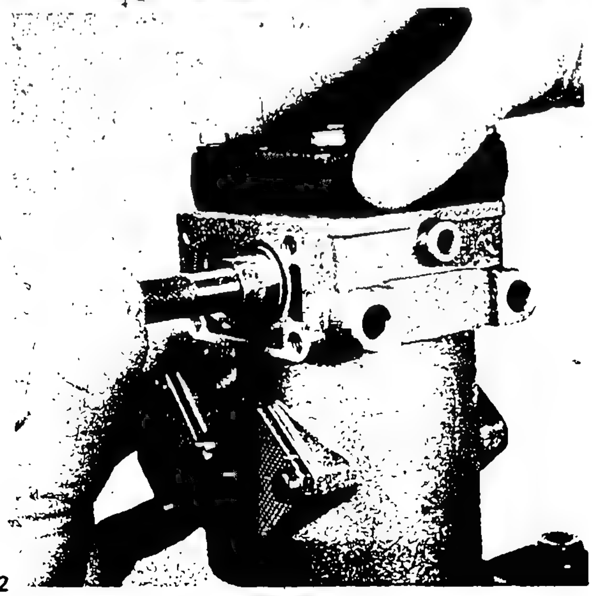
Position of the governor-control piston port see Section "Setting the governor-control piston spring".

51

In this way the tool is properly guided.
Push the tool in the direction of the hydraulic head. By moving the hydraulic head lightly back and forth, it can be determined whether or not the front face of the tool is making contact across the whole of the face.

If this is the case, the pump housing holes are aligned with the holes in the hydraulic head.

Tighten the fastening screws.

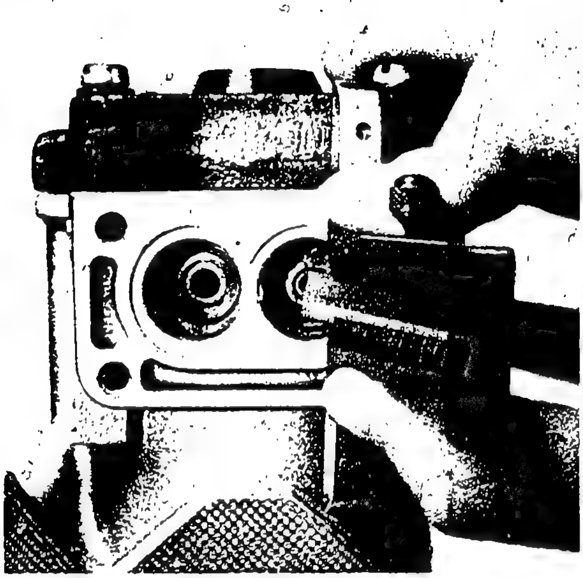


52

53

Fit the O-ring on the shaft of the delivery rate control device.
(Use assembling sleeve.)
Do not forget the washer.

The shaft of the delivery rate control device differs to that of the speed control device in that the former has a larger bore.



54

Setting the governor-control piston spring:

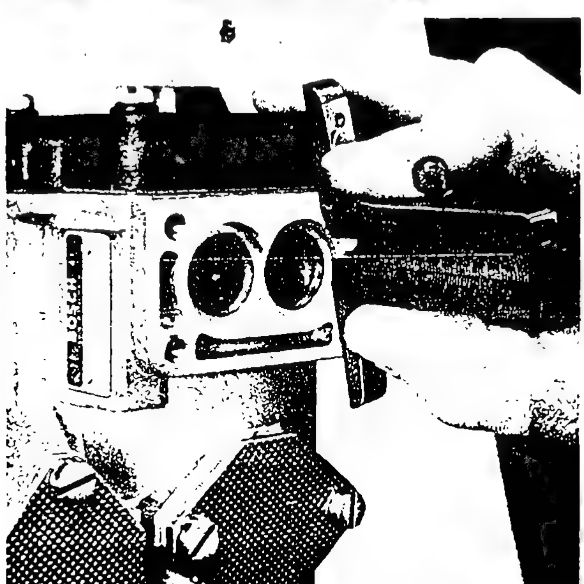
Insert the control piston carefully without tilting.

Normal fitting position: (timing device above)

With control lever fitted on the right (looking at threaded end of drive shaft), control piston below, throttle above.

With control lever fitted on the left (looking at threaded end of drive shaft), governor-control piston above, throttle below. Push the control piston up against the mechanical stop.

Measure from the seating surface of the stop plate on the pump housing to the seating surface of the spring on the control piston (dimension a).



55

Measure the depth of the recess in the housing for the control device bushing (dimension b).

Dimension b substracted from dimension a = dimension c.

Measure the distance inside the delivery rate control device shaft, from the end face to where the governor-control piston seats (dimension d). There is to be no disc in the shaft. (Fig. 56)

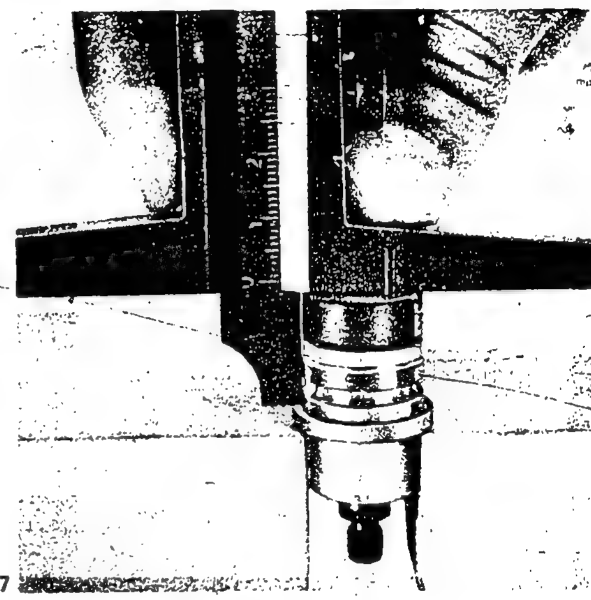
56

Insert the shaft, with washer, into the bushing.

Measure the distance from the end face of the shaft to the bushing shoulder (dimension e). (Fig. 57)

Dimension e subtracted from dimension d = dimension f.

Dimension c plus dimension f = dimension g.
Dimension V (see Test-Specifications Sheet) subtracted from dimension g = thickness of disc to be inserted in the shaft.



57

Example:

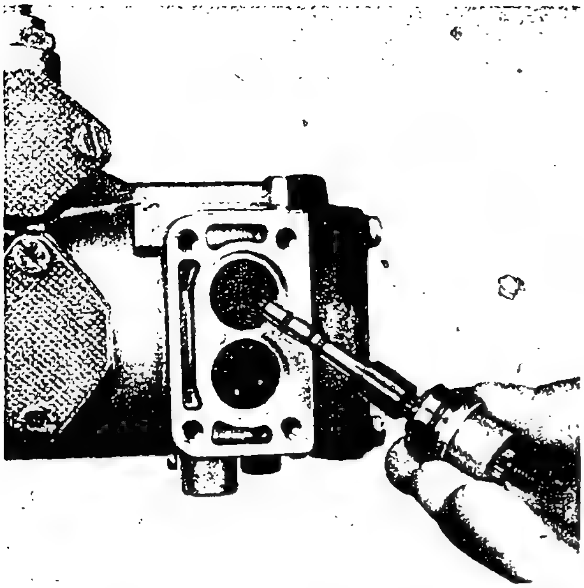
	Dimension a	27.2 mm
–	Dimension b	– 2.5 mm
=	Dimension c	= 24.7 mm
	Dimension d	19.2 mm
–	Dimension e	– 18.7 mm
=	Dimension f	= 0.5 mm
	Dimension c	24.7 mm
+	Dimension f	+ 0.5 mm
=	Dimension g	= 25.2 mm
	Dimension g	25.2 mm
–	Dimension V (Test Specifications Sheet)	– 24.2 mm
=	Disc thickness	= 1.0 mm

Fit the O-rings on the shaft (with assembling sleeve) and on the bushing of the speed control device.

For collar fitting, assemble the speed control device in the following order:

Bushing on shaft (with washer in between), collar, spring, throttle with spacer. (Fig. 58)

58

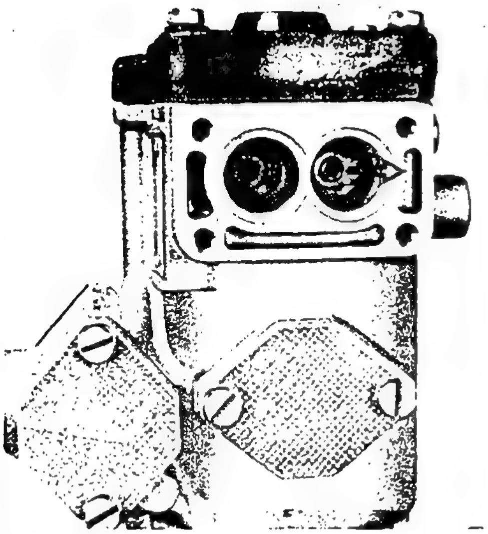


59

With collar fitting, a collar with internal splines provides the connection between shaft and throttle.
The spring is installed to take up excess play.

Note: If the throttle helix climbs to the right the spring must be counterclockwise-wound, and vice versa.

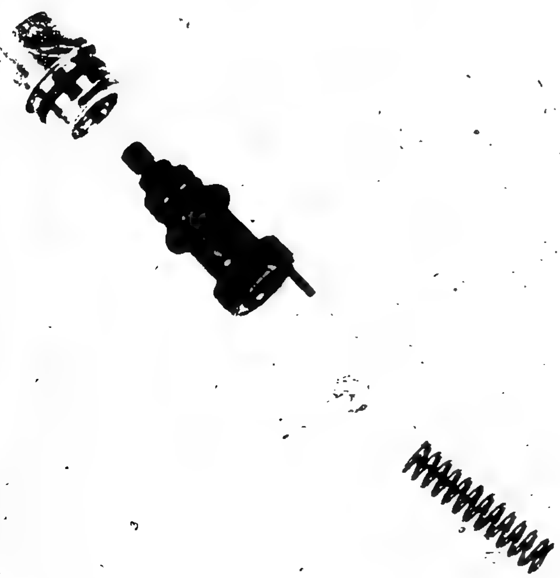
Place the collar on the shaft splines when assembling (only possible in one position due to "lost tooth").
Stick one end of the spring in the small hole of the shaft, the other in the small hole in the throttle. Tension the spring by turning the throttle in the direction in which the spring is wound until it is possible to push the throttle into the collar.
The splines on the collar, shaft and throttle must be dry and free of grease when making the connection.
Carefully insert the complete assembly. (Fig. 59)



60

Rotate the governor-control piston so that the notch points away from the throttle port (in direction of arrow).

The notch on the shaft of the speed control device must point in the same direction.



61

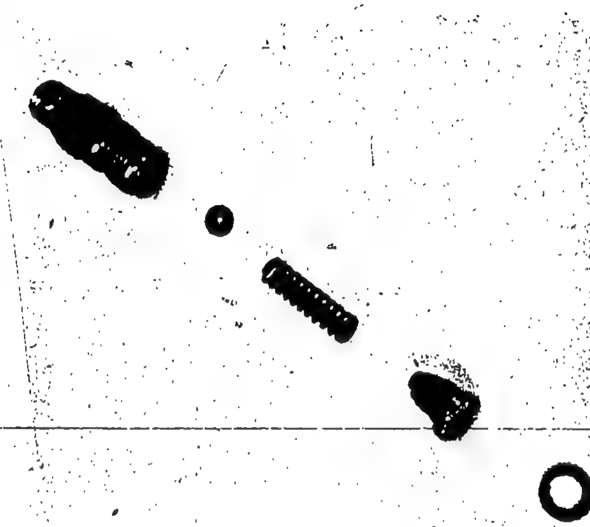
Fit the O-ring over the bushing of the delivery rate control device.
Slide the shaft into the bushing.
Place the disc (thickness determined on previous page) in the shaft and push the governor-control piston spring into the shaft and up against the disc.
Fit the complete delivery rate control device in the housing so that the drive pin on the shaft engages the notch in the governor-control piston.

Press the delivery rate control device and the speed control device against the hydraulic head and fit the stop plate.

Install seal rings and delivery valves. Screw in delivery valve holders, with springs, and washers and fillers if necessary.

Attention:

It is imperative that the delivery valve holders are tightened with exactly the torques specified on page 3.



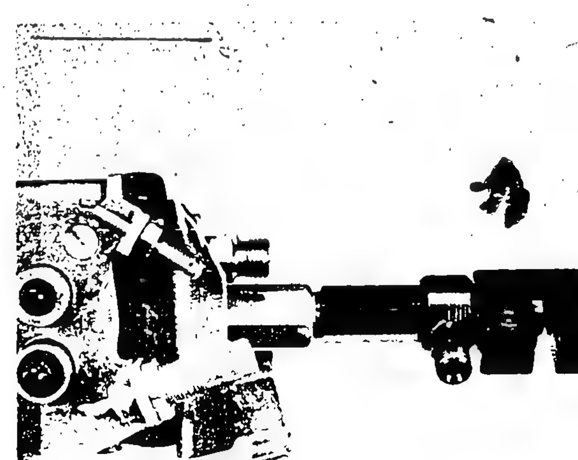
62

Attach the measuring device for setting pre-stroke and one of the two extensions (thread M 12 x 1 or M 14.5 x 2). (Fig. 63)

Fit pressure regulating valve (complete with O-rings).

Fitting position:

On the left when looking at threaded end of drive shaft.



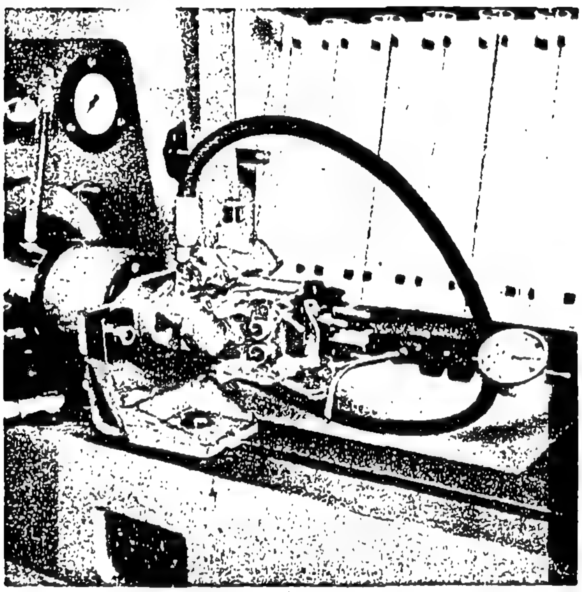
63

6. Setting the pre-stroke

Remove the pump from the clamping support and mount it in the clamping bracket of the injection pump test bench. Connect the drive coupling.
Clamp the pump on the test bench in such a way that the coupling is stressed.
To do this, fit the pump drive coupling into the back-lash-free drive coupling of the test bench. Loosen clamping bracket fastening screw and pull bracket (together with pump) away from drive coupling, hold bracket in this position and tighten fastening screw.

Connect the test oil supply hose.

Fit the dial indicator the pre-stroke measuring device and with the plunger at BDC, slide the dial indicator along its rod until the small hand reads 4 mm/0.158 in.

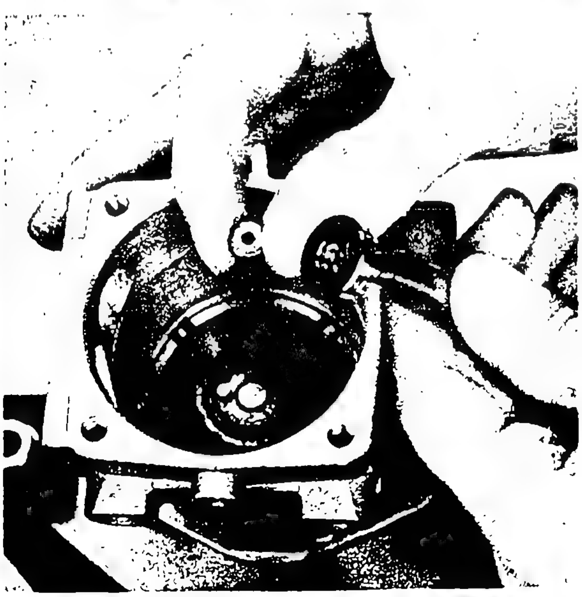

64

Switch on the test bench. Set test oil supply pressure to 0.2 bar/2.8 lb/in^2. The governor-control piston is not to be in the "stop" position.
Turn the plunger to BDC and set the large hand of the dial indicator to "0" (test oil flows out through the measuring device overflow pipe).

Turn the drive shaft in the direction of rotation of the pump until no more test oil comes out of the overflow pipe (start of pump delivery).

Read-off the dial indicator. (Fig. 64)

Turn the drive shaft slowly in the opposite direction. After max. 0.02 mm/0.0008 in less stroke, test oil should once again start to drip. Repeat pre-stroke measurement.


65

Compare the value read-off from the dial indicator with the pre-stroke specified in the appropriate Test Specifications Sheet (VDT-WPP..).

Compensate for deviations from specification by placing appropriate washers under the plunger base. To do this, remove the pump from the test bench and secure it in the clamping support, remove governor-control piston and throttle, take off hydraulic head and reinstall after fitting correct washer.

If the pre-stroke is excessive, fit a thicker washer; if it is inadequate, fit a thinner washer.

If one has to choose between two different washer thicknesses, the thicker washer should be chosen. Carry out check measurement when finished. (Fig. 65)

WJP 16114

Measure the cam plate lobe-height (stroke):

When taking the measurements necessary for the fitting of the plunger return spring the height of the lobe on the cam plate is important. It is measured at this opportunity by rotating the drive shaft so that the plunger travels from BDC to TDC. This length of travel of the plunger corresponds to the lobe height and can be read on the dial indicator.

When measuring the pre-stroke of distributor-type pumps for two and three-cylinder engines, please note that the cam plates from pumps from four-cylinder respectively six-cylinder engines are used. Therefore only every second upward stroke is actually a delivery stroke.

This is confirmed during pre-stroke measurement on pumps for two or three-cylinder engines by the fact that the plunger travels from BDC to TDC without the flow of test oil from the overflow pipe being interrupted. Pre-stroke can be measured during the next upward stroke.

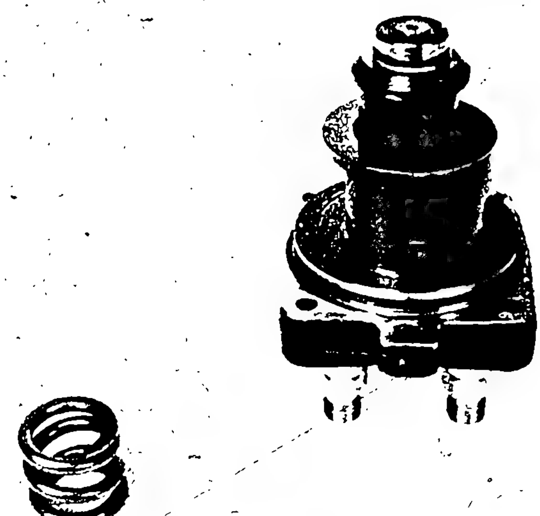
Set the timing pointer according to the data in the Test Specifications Sheet. Attach the cover. Do not forget the seal ring.
Remove the pump from the test bench and secure it in the clamping support.

Remove the pre-stroke measuring device, screw in the central plug and tighten it with the prescribed torque. Use a new seal ring.

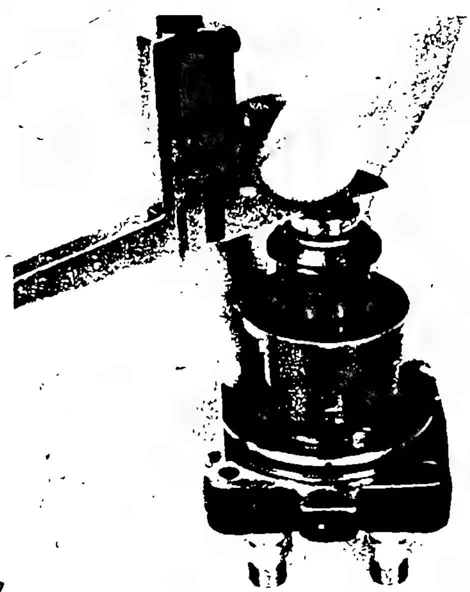
Remove the hydraulic head.

Plunger return spring fitting:

Place the spacer sleeve (instead of the plunger return spring) and spring seat with washers on the hydraulic head and insert the plunger (with the appropriate washer, as determined whilst setting the pre-stroke, on the plunger base) into the hydraulic head. (Fig. 66)

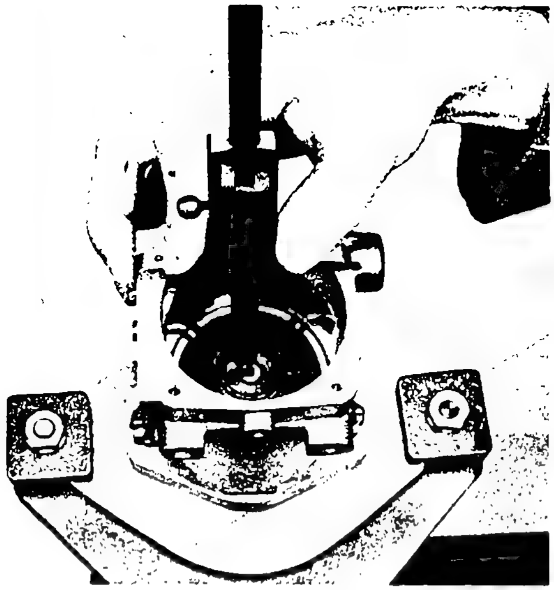


66



Measure from the plunger base washer to the seating surface of the hydraulic head (distance h). (Fig. 67)

67



68

Set the cam plate to BDC.

Measure from the seating surface of the pump housing to the center of the cam plate (seating surface of the plunger base washer). (Distance i) (Fig. 68)

Compare distance h to distance i.

General case:

Compensate for difference between distance "h" and "i" by fitting appropriate washer(s) between plunger base and spring seat.

However, note:

On cam plates with 2.5 mm/0.098 in lobe height, the length of the return spring, when fitted, is the same as that of the spacer sleeve. This applies to the general case above.

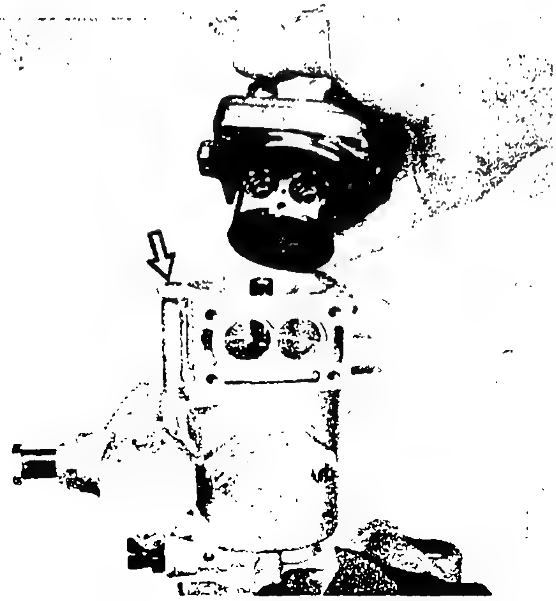
For smaller lobe heights (e.g. 2.2 mm/0.087 in) distance h must be larger than distance i by exactly the difference between the lobe height and 2.5 mm/0.098 in (e.g. 0.3 mm/0.012 in).

For larger lobe heights (e.g. 2.8 mm/0.11 in) distance h must be less than distance i by exactly the difference between the lobe height and 2.5 mm/0.098 in (e.g. 0.3 mm/0.012 in).

69

Place the washers, as determined during plunger return spring fitting, on to the plunger. Fit the washer with the lubricating grooves last so as to be next to the spring seat. Put the spring seat on the washers and the return spring on the seat.

With the appropriate washer (as determined during setting of the pre-stroke) between plunger base and cam plate, fit the complete assembly on to the cam plate in such a way that the cam plate drive pin fits into the plunger base notch. (Fig. 69).



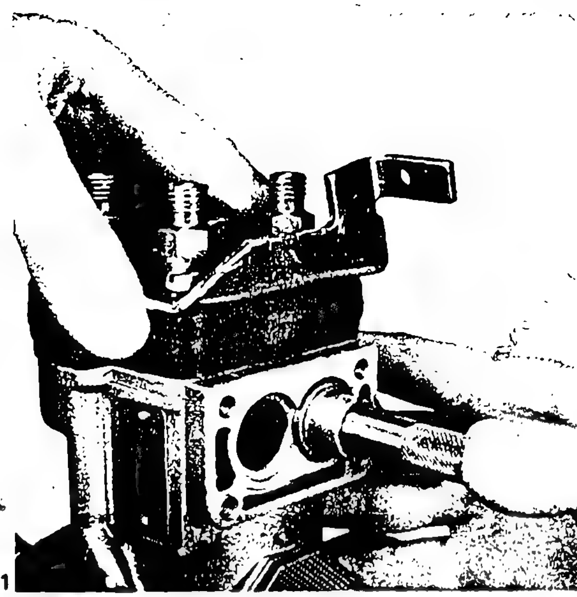
70

Make sure that the large hydraulic head seal ring is not damaged and that the small seal ring has been placed in the housing (arrow).

Without tipping it or damaging the seal rings, insert the hydraulic head slowly and carefully over the plunger and into the housing. (Fig. 70)

W3P 16114

To align the hydraulic head correctly with the pump housing tighten the four fastening screws first (fit the bracket for the Bowden remote control cable, if included). Then loosen each screw one half-turn and insert the auxiliary tool (manufactured according to drawing 5, page 31 and with bushing of delivery rate control device fitted) into the governor-control piston port. Press the tool against the hydraulic head and move the latter lightly back and forth. When it is felt that the front face of the tool is flat up against the end of the control piston port in the hydraulic head, the fastening screws are to be tightened. (Fig. 71)

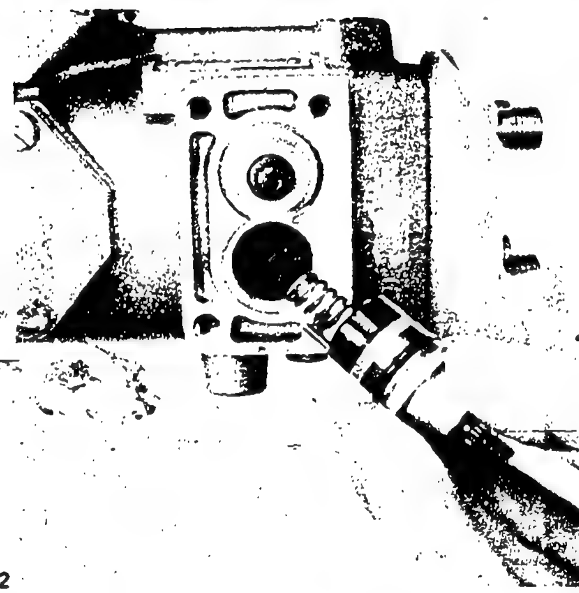


71

Carefully install the throttle and the complete speed control device.
Carefully install the governor-control piston.
Rotate the control piston so that the notch points away from the throttle port.

Fit the complete delivery rate control device so that the drive pin engages in the notch in the control piston.

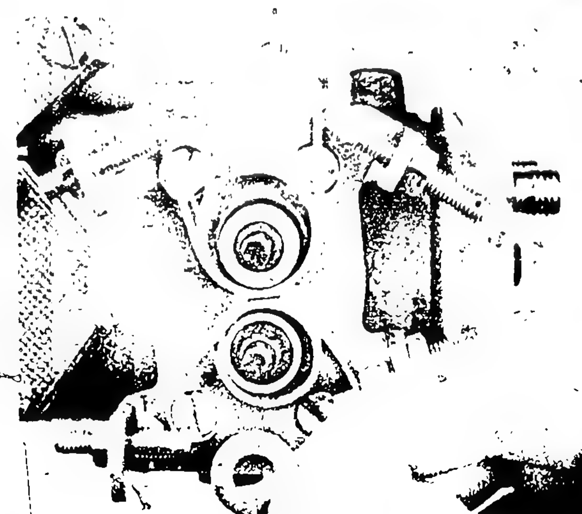
Push the delivery rate control device and the speed control device against the hydraulic head and fit the stop plate. (Fig. 72)



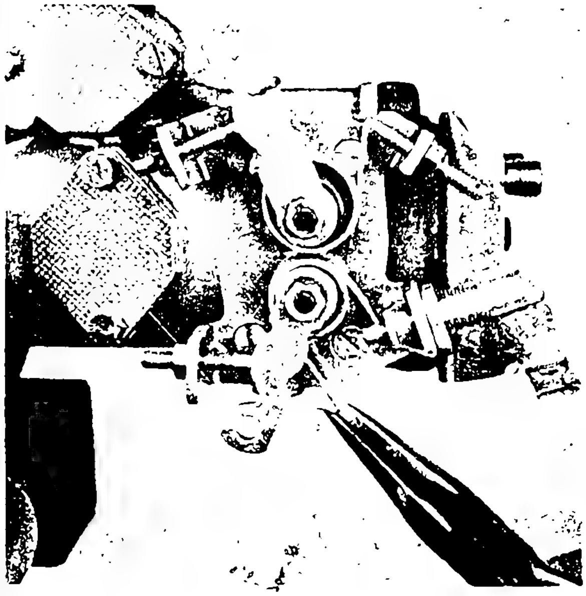
72

In the case of a throttle with collar fitting check that the play-compensating spring is still engaged.

To do this fit the torsion springs and the washer under the delivery rate control lever. (Fig. 73)



73



74

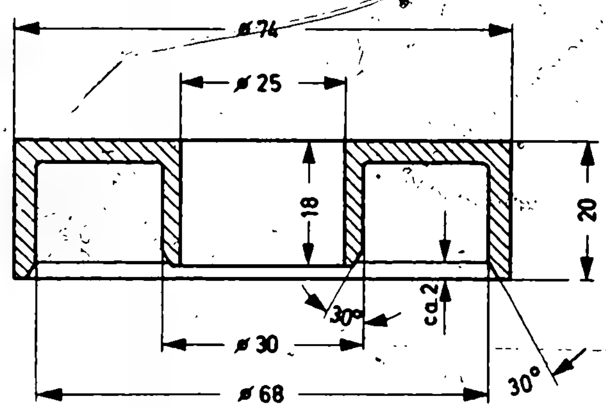
Attach the delivery control lever (shorter than the speed control lever) and speed control lever and secure them with lock washer and nut.

Move the speed control lever lightly back and forth and check to see that the throttle can be rotated without play.
If backlash is perceivable (in the splines of the shaft, the bushing and the throttle) this indicates that the play-compensating spring has jumped out its seat.

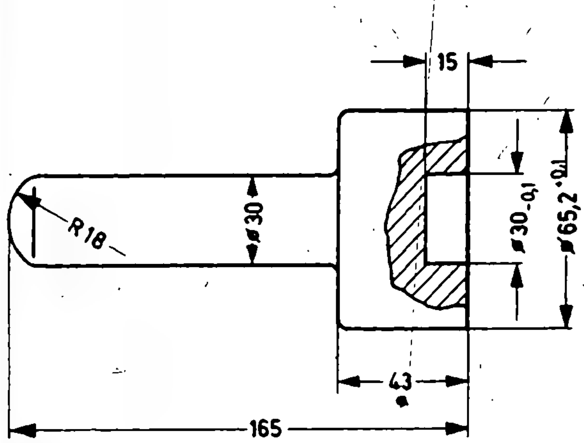
Remove the speed control device, disassemble, re-engage play-compensating spring, reassemble and install again.

Engage torsion spring. (Fig. 74)

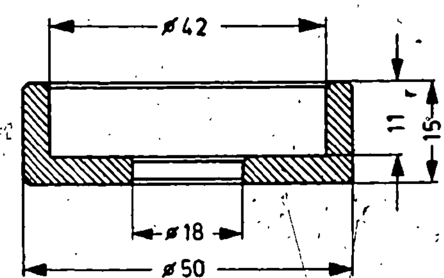
7. Auxiliary tools



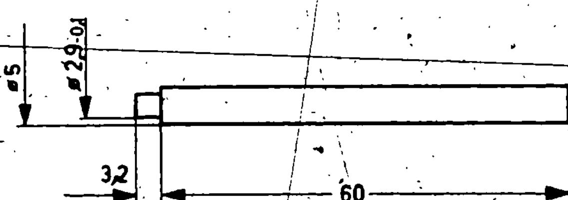
Drawing 1
Material: Hardwood or plastic
All measurements metric. ϕ = dia.
ca. = approx.



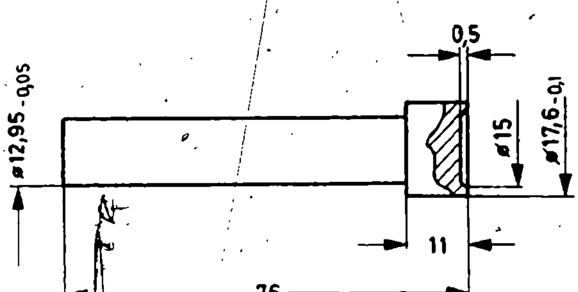
Drawing 2
Material: Hardwood or plastic
All measurements metric. ϕ = dia.



Drawing 3
Material: Hardwood or plastic
All measurements metric. ϕ = dia.



Drawing 4
Material: Steel
All measurements metric. ϕ = dia.



Drawing 5
Material: Steel
All measurements metric. ϕ = dia.

EM

BOSCH

REPAIR INSTRUCTIONS

46

VDT-WJP 161/4 B Suppl. 1
Ed. 1

Distributor-type Fuel Injection Pump

EP/VA . . H . . C . .

This supplement contains new developments which apply to the indicated sections of instructions VDT-WJP 161/4 B when repairing distributor-type fuel injection pumps EP/VA..H..C..:

a) Sieve ring

b) Pre-stroke

c) Removal of a tilted eccentric race

d) Electrical shut-offs

e) Correction

Neudruck

E12

a) Sieve ring

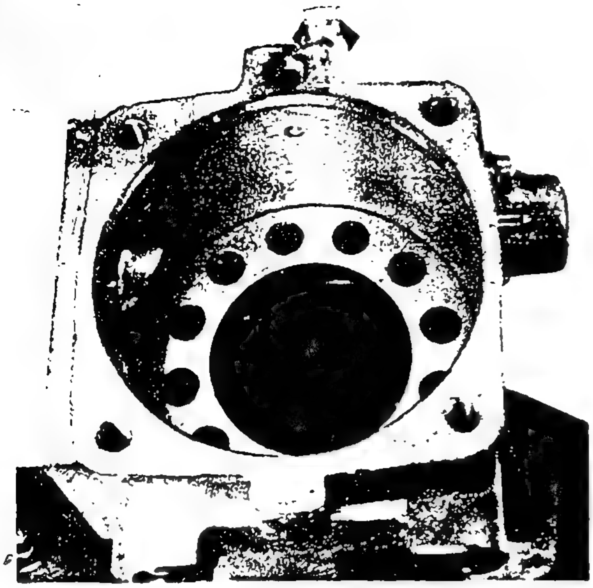
Disassembly

Between Figs. 7 and 8

Text before "Take out the cam plate".

On pumps with sieve rings, remove the sieve ring and the spring washer.

"Take out the cam plate".



1

Assembly

Between Figs. 48 and 49

Text before "Position the washer on the cam plate so that it will fit into the plunger base recess".

Fit the spring washer on the lug in the housing and then the sieve ring on the spring washer.

Note installation position:

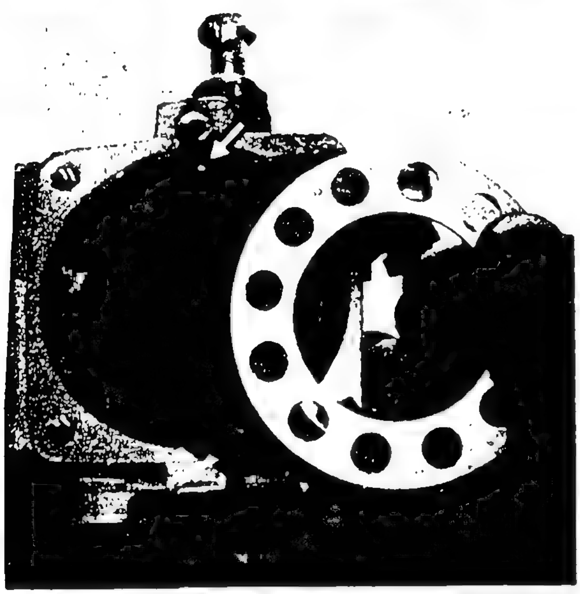
Fit the spring washer so that the sieve ring rests on the inner part of the spring washer and the hole side of the sieve ring is visible from the outside.

Fit the sieve ring so that the sieve holes are not covered by the spring washer tongues.

The sieve ring and spring washer are held in place by the hydraulic head, when fitted, pressing the sieve ring against the spring washer.

Blow out the vent hole (arrow).

"Position the washer..."



2

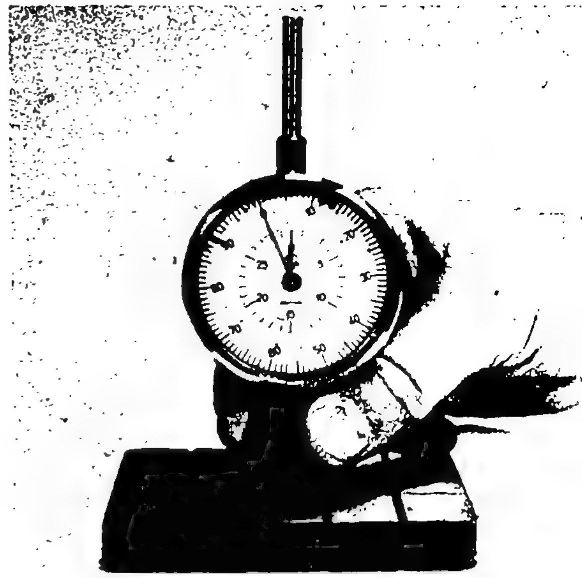
b) "Pre-stroke 0"

Between Figs. 50 and 51

Text before "To align the hydraulic head correctly..."

On pumps with "pre-stroke 0" (according to Test Specification Sheet), fix the hydraulic head to the pump housing with all four screws.

Mount the dial indicator 1 687 233 012 – EFAW 63 in the measuring device KDEP 1032.
Using a marking-off table or similar device, pre-load the dial indicator 30 mm and set the gage at 0.



3

Fig. 4
A number is stamped or engraved on the hydraulic head top or on the control lever side. The figure shows both possibilities. The number 345 means 23.45 mm (specified value). If the number 335 for example, is stamped on the hydraulic head, the specified value is 23.35 mm.

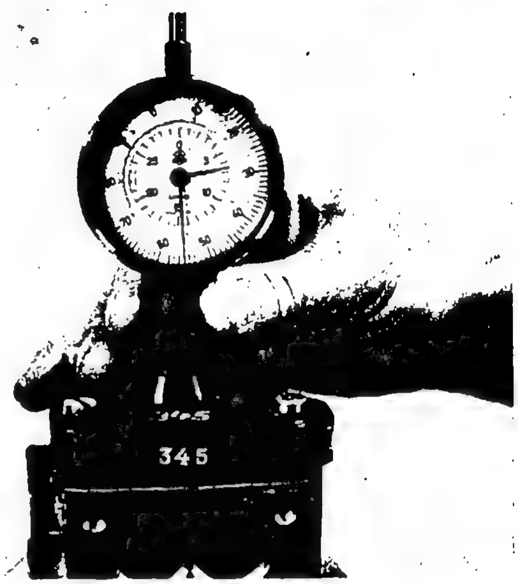
Thus, the value given on the hydraulic head is without the initial number 2 and the decimal point.

Set the pump plunger at BDC (bottom dead center).

Introduce the dial indicator feeler pin into the tapped hole of the central screw plug. Place the measuring device KDEP 1032 flat on the sealing surface for the central screw plug and measure to the plunger top.

When doing so, note that the measurement is subtracted from 30 mm. Therefore, the value cannot be read directly from the gage.
Example:
If the dial indicator shows a reading of 6.5 mm, the actual measured value is 23.5 mm.

The value shown in the example in Fig. 4 is 23.45 mm.



4

Compare the indicated value (actual value) with the specified value given on the hydraulic head. Any difference between the actual value and the specified value should be corrected by placing appropriate washers in the plunger base.

If the actual value is larger than the specified value, a thicker washer must be used; if it is smaller, a thinner washer should be fitted.

Measure the cam lift (stroke). (Important for the operation "Plunger return spring fitting" described in VDT-WJP 161/4 B, p. 27).

For this purpose, screw measuring device KDEP 2940 with dial indicator 1 687 233 011 – EFAW 7 for thread M 12 x 1 and central screw plug for thread M 14.5 x 2 into the hydraulic head.
Screw device KDEP 1026 with dial indicator 1 687 233 011 – EFAW 7 into screw plug (M 14.5 x 2).

Measure and record cam lift.

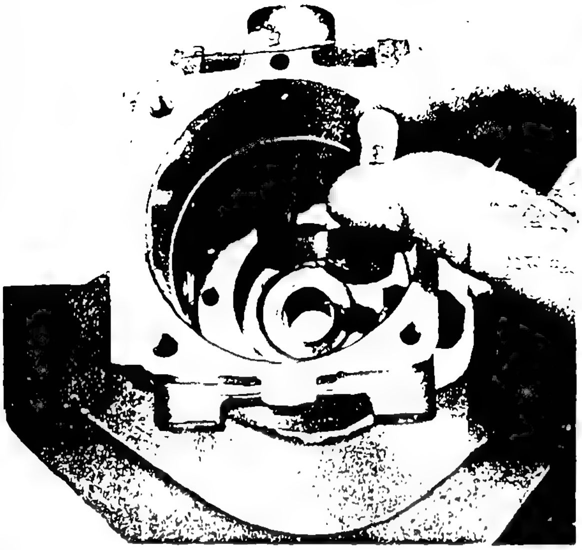
Adjust the timing pointer according to Test Specification Sheet.
In pumps with "pre-stroke 0", the hydraulic pre-stroke measurement (p. 25, 26) is not carried out.

c) Removal of a tilted eccentric race

Between Figs. 21 and 22.

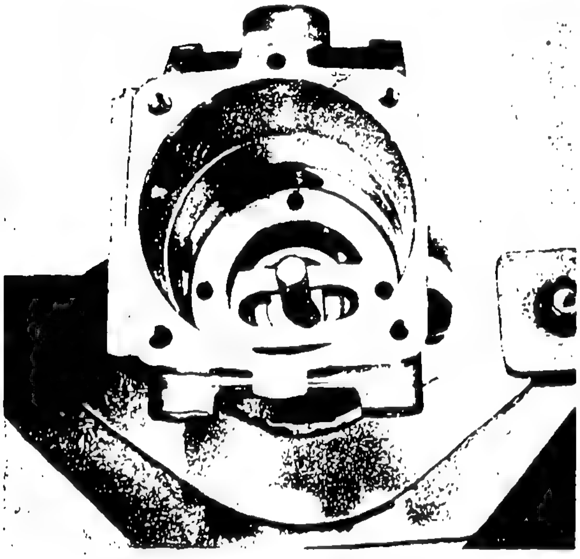
Text before "Remove the retainer".

If the eccentric race still tilts, it must be removed. For this purpose, slip a device (manufacture according to drawing 1, p. 8) under the eccentric race.



5

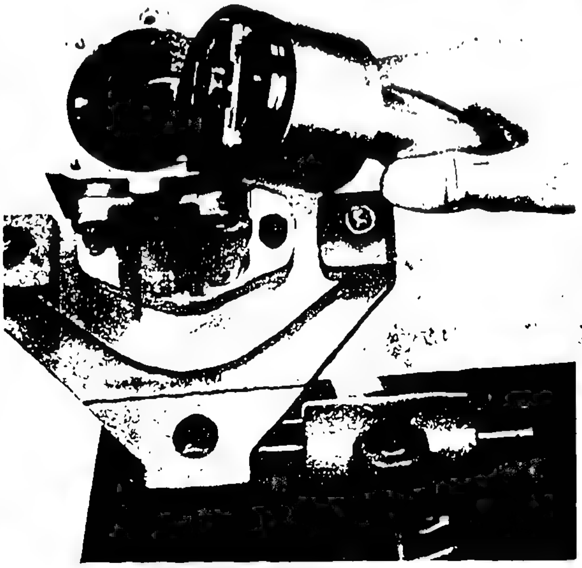
Centrally align the device (stud head in the notch of the extractor part.)



6

The self-manufactured auxiliary tool (drawing 2, p. 30 in VDT-WJP 161/4 B – note addition to drawing 2, p. 8 – thread M 10, 50 mm deep) should be screwed onto the stud of the device. If necessary, hold the stud with a screwdriver through the drive shaft hole in the housing. The eccentric race is now held between the extractor and the auxiliary tool.
By pushing and pulling on the auxiliary tool grip, the tilted eccentric race is loosened and can be removed together with the tools.

Note:
This operation may cause shavings, which must, on all accounts, be removed.



7

d) Electrical shut-offs

Pumps with electrical shut-offs are special models which will be included in the annex to VDT-WJP 161/4 B.

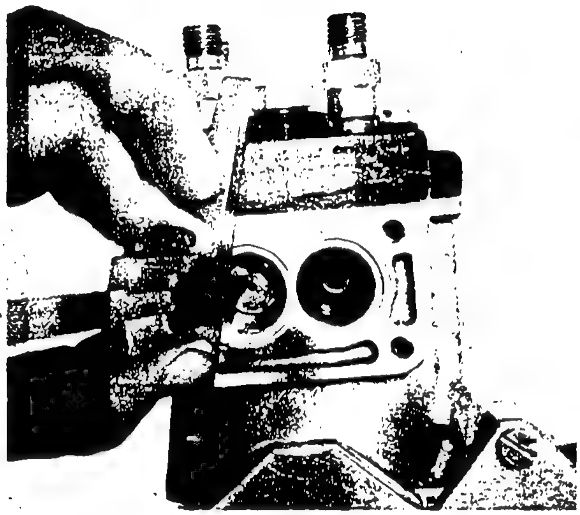
The electromagnet on pumps with electrical shut-offs is fastened to the side opposite the control lever with 4 screws.

Note.
In the magnet is a pin which is not fixed in place. Do not lose this pin.

A spring presses against the throttle.
This spring must be installed with a given initial tension.

The spring is set in a similar way to the spill piston spring (VDT-WJP 161/4 B, p. 22 and 23).

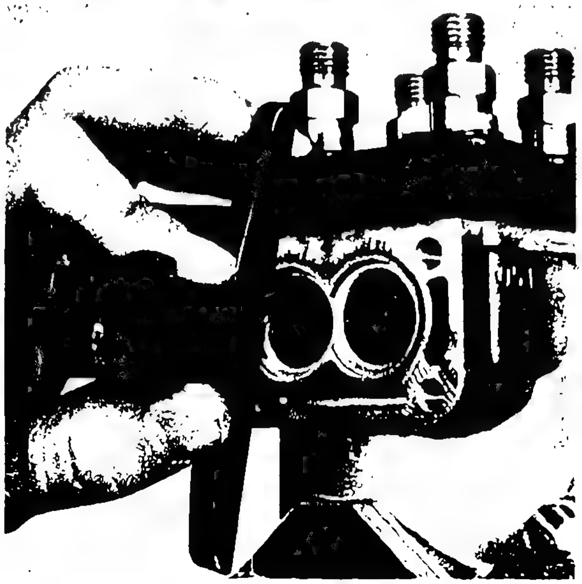
Push the throttle into the hydraulic head until it fits against the surface. Measure the distance from the stop plate on the pump housing to the spring seat of the throttle (dimension k).



8

Measure the depth of the cylindrical countersink for the control device bushing (dimension l).

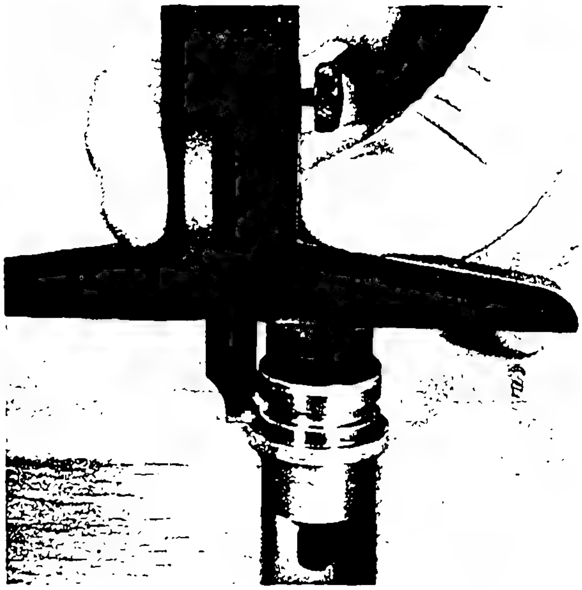
Dimension l subtracted from dimension k equals dimension m.



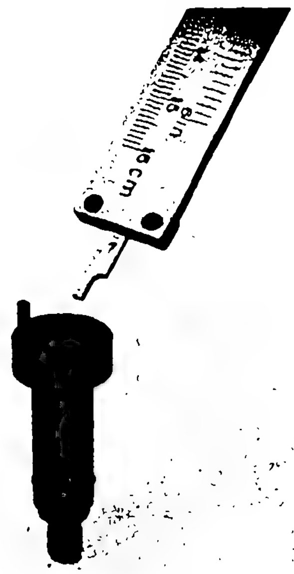
9

Fit the shaft of the speed control device with washer into the bushing. Measure the distance from the end face of the shaft to bushing shoulder (dimension n).

Dimension n subtracted from dimension m equals dimension o.



10



11

Fig. 11
Measure the distance from the end face of the shaft to the spring seat in the shaft with a slide caliper rule (dimension p). There should be no washer in the shaft

Note:
A center is located in the shaft hole. Do not measure into the center.

Dimension p plus dimension o equals dimension q.

Dimension VI (see Test Sheet) subtracted from dimension q indicates the thickness of the washers to be used.

Example

	Dimension k		23.0 mm
–	Dimension l	–	2.5 mm
=	Dimension m	=	20.5 mm
	Dimension m		20.5 mm
–	Dimension n	–	16,9 mm
=	Dimension o	=	3.6 mm
	Dimension o		3.6 mm
+	Dimension p	+	9.6 mm
=	Dimension q	=	13.2 mm
	Dimension q		13.2 mm
–	Dimension VI (see Test Sheet)	–	12.4 mm
=	Washer thickness	=	0.8 mm

All other operations in repairing pumps with electrical shut-offs are the same as described in VDT-WJP 161/4 B.

Test instructions

The electromagnet must be switched on while testing pumps with electrical shut-offs, i.e. the voltage indicated in the Test Sheet must be applied.

Testing the magnet

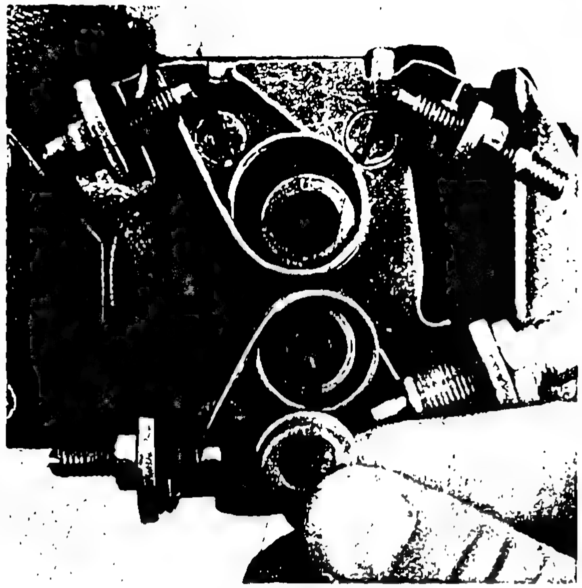
The magnet must pull-in at the cut-in voltage indicated in the Test Sheet.

e) Correction

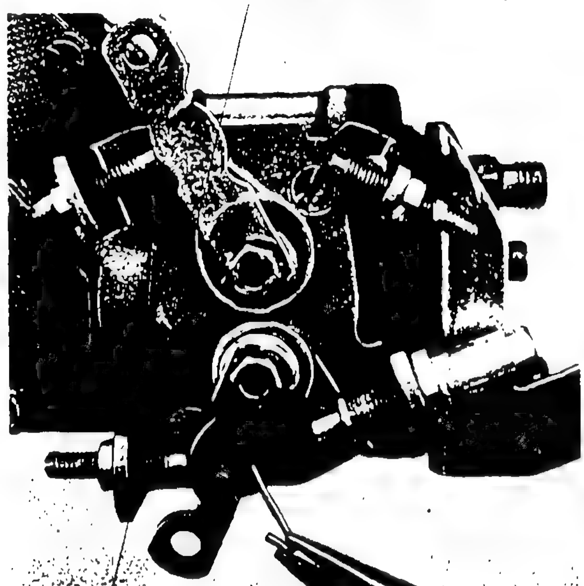
The torsion spring for the speed control device shown in the figures in instructions VDT-WJP 161/4 B was inadvertently shown in the wrong location.

The spring must be engaged as shown in Figs. 12 and 13 of this supplement.

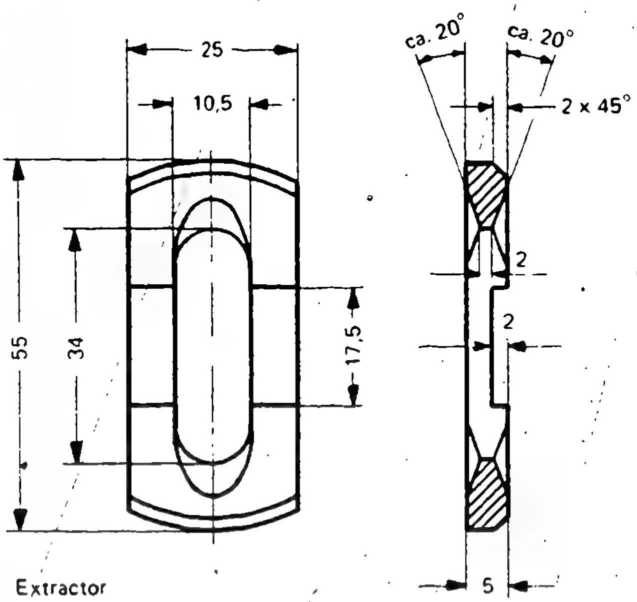
Please take note of this correction.



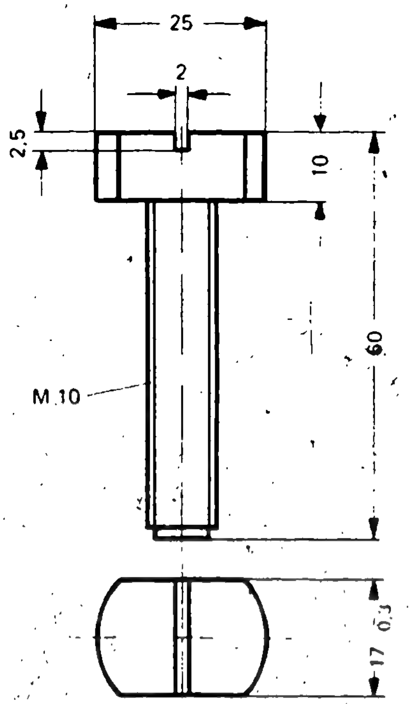
12



13

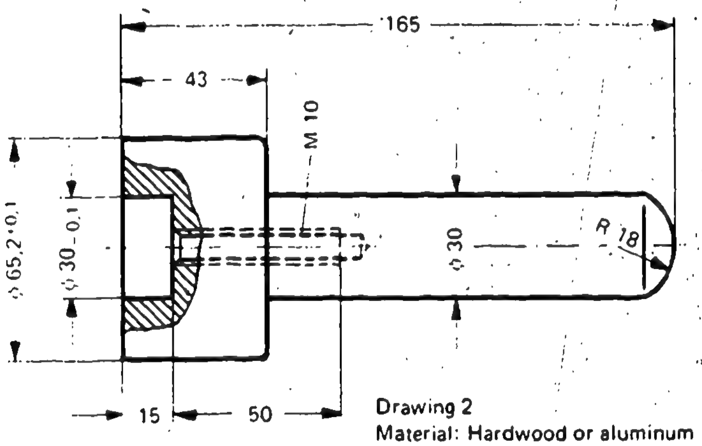


Extractor



Stud

Drawing 1
Material: Steel



Drawing 2
Material: Hardwood or aluminum

ca. = approx.
ϕ = dia.

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BOSCH

REPAIR INSTRUCTIONS

46

VDT-WJP 161/4 B Suppl. 2
Ed. 1

Distributor-type Fuel Injection Pump

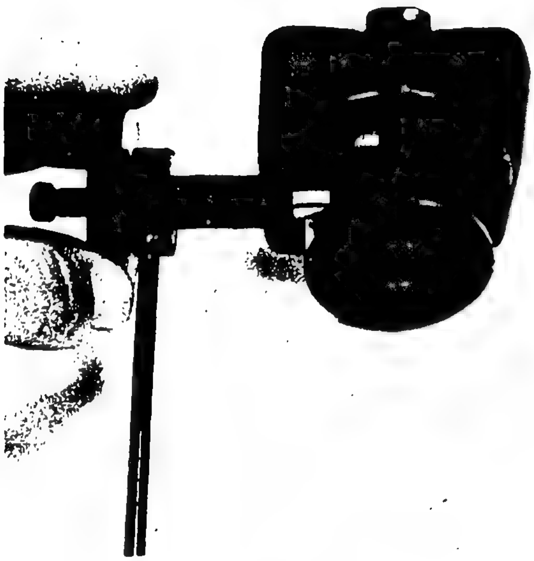
0 460 . . **EP/VA . . H . . C . .**

This supplement contains new developments which apply to indicated sections of Repair Instructions VDT-WJP 161/4 B and which are to be taken into account when repairing distributor-type fuel injection pump EP/VA..H..C..:

1. Repair of the automatic excess fuel starting device in distributor-type fuel injection pumps **without** electrical shut-off.

2. Removing and fitting the retainer on the drive shaft.

1



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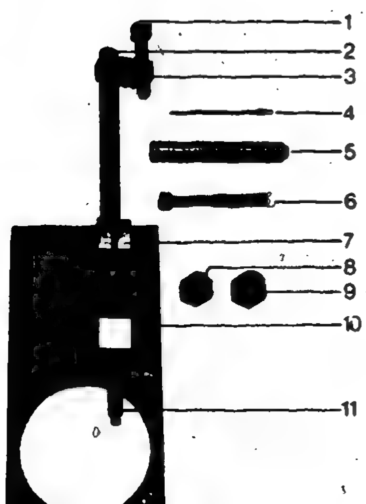


3

1. Repair of the Automatic Excess Fuel Starting Device

The following information should be inserted in Section 4 ("Repairing the Hydraulic Head") of Repair Instructions WJP 161/4 B following the description of repair of a hydraulic head with a leaky non-return valve.

Disassembly of Parts

Insert the puller, KDEP 1027 without spring pin, far enough into the clamping sleeve in the hydraulic head. (Fig. 1)

Insert the spring pin.

Withdraw the clamping sleeve by turning the hand wheel and applying counter-pressure to the holding pin.

Remove the starting piston and spring by tapping the hydraulic head against a piece of wood.
Using a punch (diameter about 4 mm), drive the plug out from the clamping sleeve side.

A stuck starting piston should also be driven out, together with the spring and the plug, from the clamping sleeve side. (Fig. 2)

Repair

Check the starting piston and bore in the hydraulic head (i.e., the starting piston contact surface) for wear. If necessary, repolish the bore using tallow so that the starting piston can move smoothly.
Wash and blow out the hydraulic head.
No repair is possible if the starting piston or the bore is badly worn.

Measure the diameter of the plug which has been removed.

See VDT-BMP 161/41 for selection of the plug size.

The replacement plug must always be one size larger than the actual dimension of the plug which has been removed.

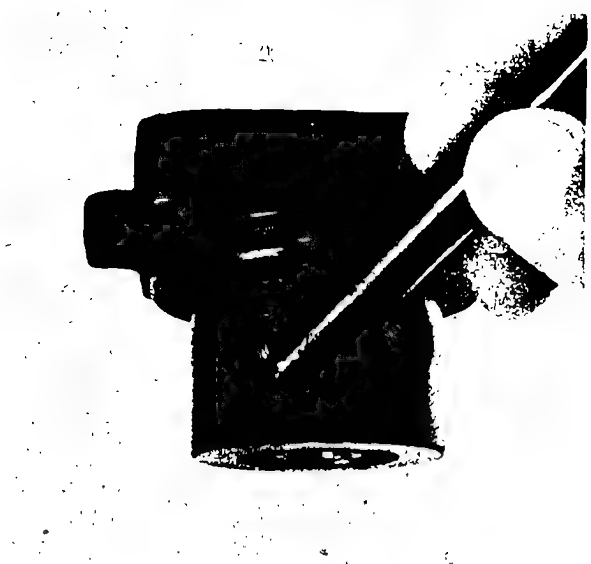
In the following assembly procedure, and in order to measure and set the gap dimension, use the pressing and measuring device, KDEP 1037. (Fig. 3)

1 Adjusting screw
2 Clamping screw
3 Swivel arm
4 Measuring adapter
5 Pressing tool
6 Reflector bracket with reflector
7 Bracket for dial indicator
8 Hollow screw
9 Hollow screw
10 Thrust screw
11 Thrust piece

Assembly

Using the pressing tool (included with the pressing and measuring device, KDEP 1037), tap the plug in as far as the pressing tool will go (to a depth of 2.9 + 0.1 mm). When doing this, be sure that the pressing tool is not tilted to any one side. (Fig. 4)

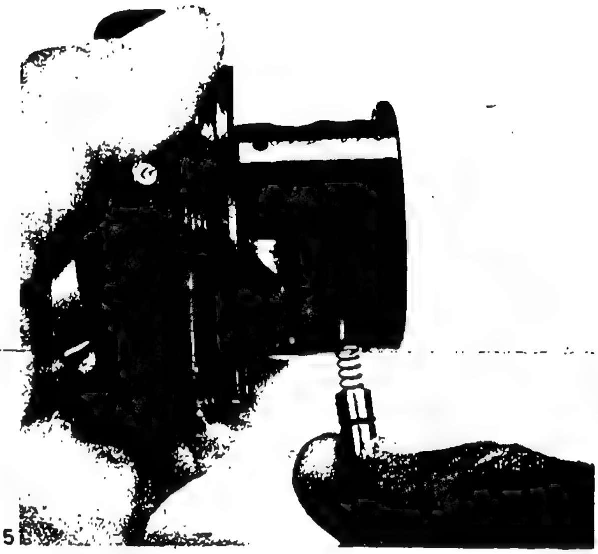
Soak the starting piston in test oil. From below, insert the spring and the starting piston into the bore in the hydraulic head and press the starting piston lightly against the plug with a suitable pin. When this is done, the spring will rest securely in its mounting in the plug and in the starting piston (Fig. 5)



4

With the clamping sleeve side towards the thrust piece, fasten the hydraulic head to the pressing and measuring device KDEP 1037. (Fig. 6)

Depending on the threads in the hydraulic head, fit the reflector bracket to either the hollow screw with thread M 12 x 1 or the holoow screw with thread M 14.5 x 2 (both screws are accessories included with device KDEP 1037).
Screw the hollow screw and reflector bracket into the threaded hole in the central screw plug in the hydraulic head, and tighten it hand-tight (Fig. 7)



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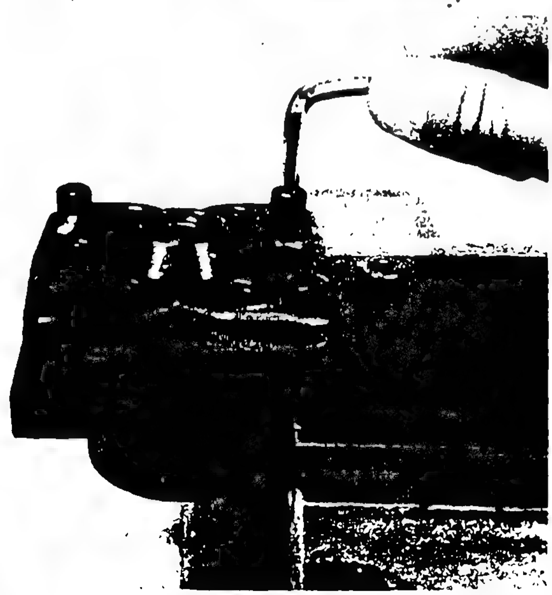

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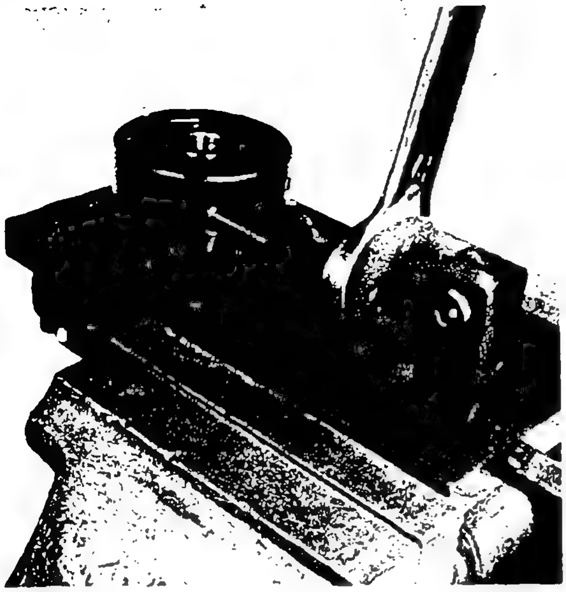
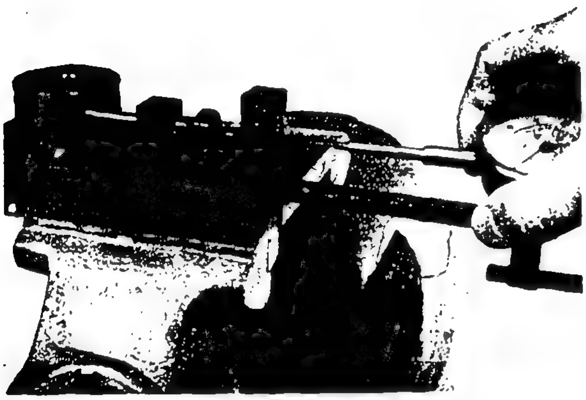


8

Place the clamping sleeve on the thrust piece and press it in place using the thrust screw. (Fig. 8)

Screw the measuring adapter (included with the pressing and measuring device, KDEP 1037) into the feeler pin of dial indicator 1 687 233 012 – EFAW 63.

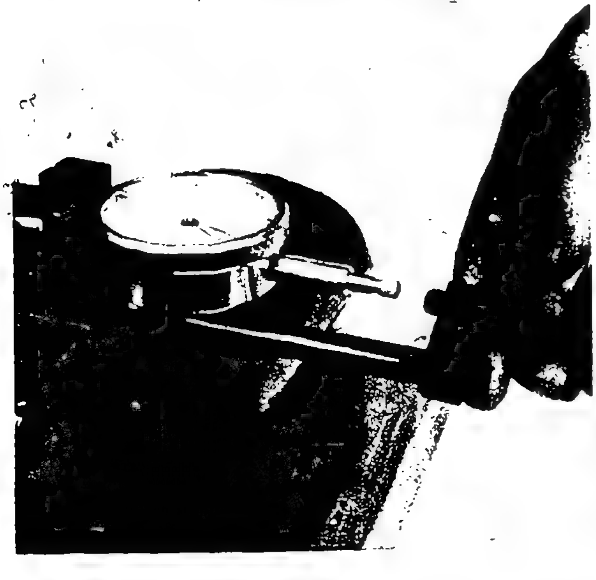
Carefully insert the feeler pin and measuring adapter into the thrust screw of device KDEP 1037. Fasten the dial indicator to the bracket. The measuring adapter must sense the position of the starting piston. (Fig. 9)



9

Swing the adjusting screw on the swivel arm so that the screw lines up with the dial indicator feeler pin. (Fig. 10)

Tighten the clamping screw at the pivot point of the swivel arm. (Fig. 11)



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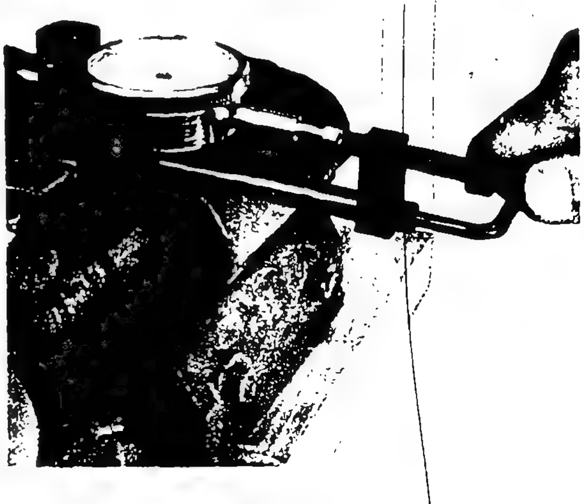
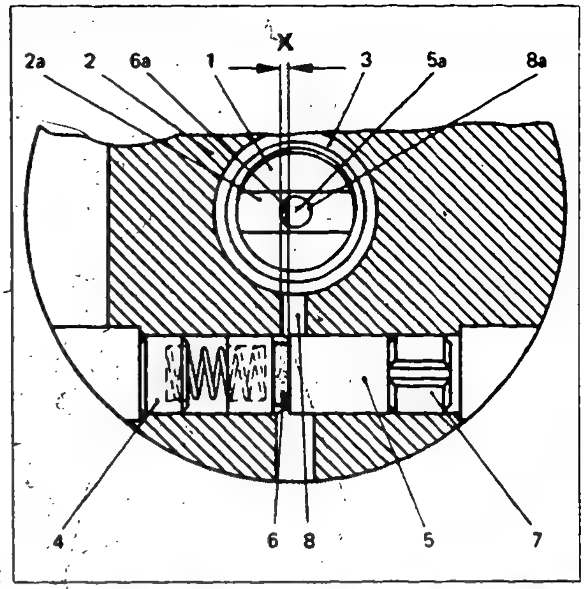


11

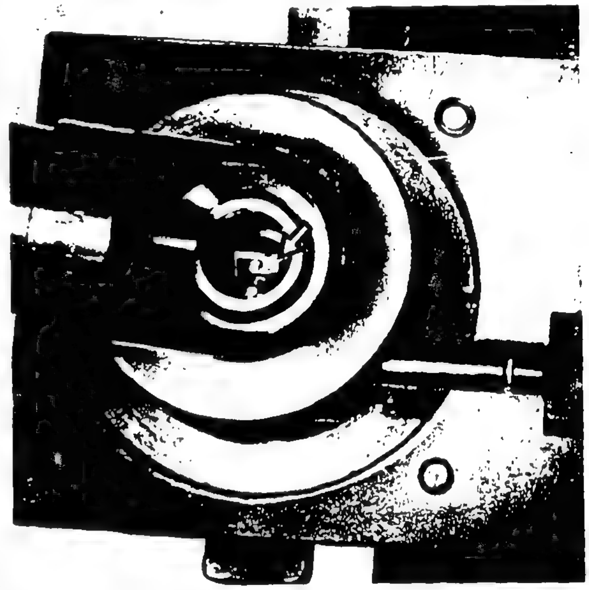
Measuring and Ajusting the Gap Dimension
(= 0.2 ± 0.01 mm; possible deviations are listed in the Prufblatt (Test Specifications Sheet) as dimension VII).
The gap dimension specifies the size of the gap (x) between the wall of the bore and the starting piston helix. (Fig. 12)

X gap dimension to be adjusted
1 Reflector
2 Hydraulic head
2a Reflected image of annular groove in hydraulic head
3 Bore for starting piston
4 Plug
5 Starting piston
5a Reflected image of starting piston
6 Annular groove in starting piston
6a Reflected image of annular groove in starting piston
7 Clamping sleeve
8 Bore (a)
8a Reflected image of bore (a)



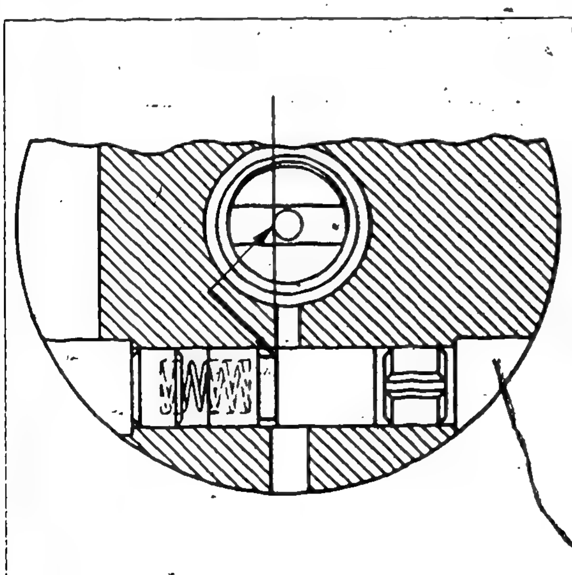
12

Align the reflector (see arrow) by turning the hex socket head cap screw on the reflector bracket so that the bore in the annular groove in the hydraulic head is well illuminated with the illuminated magnifying glass, 0 681 469 002 – EFAW 25 B, and can be easily viewed. (Fig. 13)


13

By turning the adjusting screw inward (transmitting the force through the dial indicator feeler pin and the measuring adapter), press the starting piston against the spring until the annular groove in the starting piston is seen, using the reflector and the illuminated magnifying glass, to be positioned in the bore in the hydraulic head. The annular groove stands out visibly against the polished surface of the piston. (Fig. 14)

Continue to turn the adjusting screw slowly inward until the annular groove can no longer be seen, that is, until the starting piston helix just covers the bore (see arrow). In order to recognize this position of the startin piston accurately, illuminate the left wall of the bore.
Correct the position of the reflector if necessary. Set the dial indicator to zero. In order to check this setting, turn the adjusting screw back and repeat the zero-point adjustment procedure as described above. (Fig. 15)


15


14

16

Without changing the zero-point setting of the dial indicator, back the adjusting screw off about 0.4 mm (= gap dimension + approx. 0.2 mm).

Press the clamping sleeve inward until it touches the starting piston (recognizable by the deflection of the indicator needle). (Fig. 16)

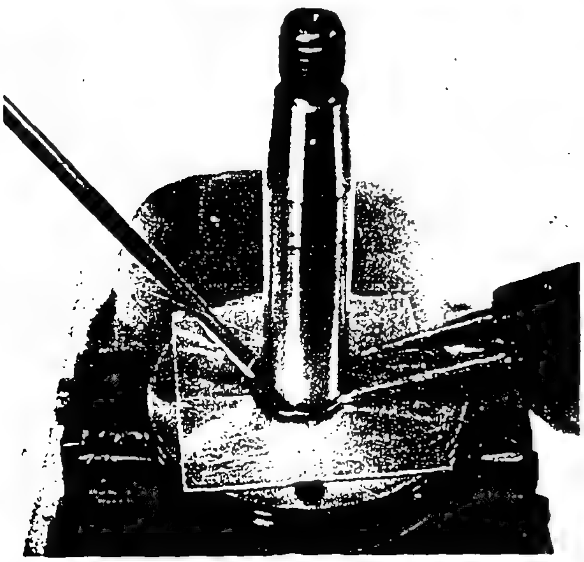
17

Press the clamping sleeve farther inward until the reading on the dial corresponds to the prescribed gap dimension.

Important:
When reading the dial, the thrust screw must not be under any load, i.e., it must be turned back. (Fig. 17)

Swing the adjusting screw with the swivel arm away from the end of the dial indicator feeler pin, detach the indicator, turn the thrust screw all the way back, remove the reflector bracket from the hydraulic head, and remove the hydraulic head from the pressing and measuring device, KDEP 1037.

Check the operation of the automatic excess fuel starting device which has just been repaired by subjecting it to the normal tests prescribed for distributor-type fuel injection pumps.



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2. Removing and Fitting the Retainer on the Drive Shaft

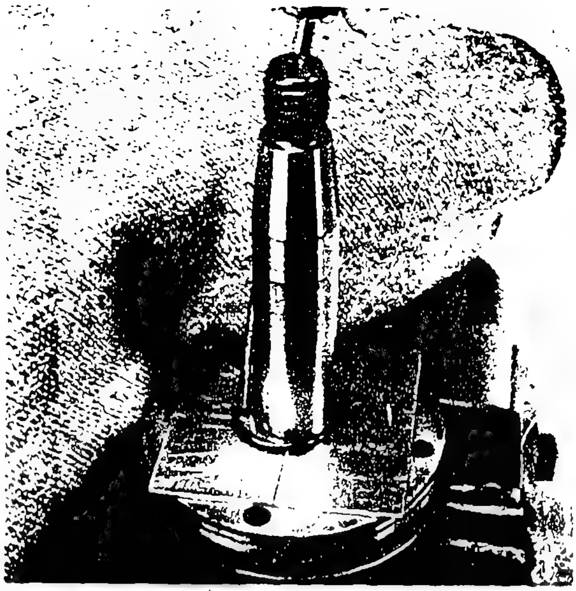
Removal

These instructions should be inserted between Figs. 21 and 22 in VDT-WJP 161/4 B, i.e., before the text which starts "Remove the eccentric race.."

Clamp the drive shaft in the vise with the drive members (use protective jaws).
Slide protective sheet (manufacture locally according to Sketch No. 1) between the fuel supply pump impeller and the retainer.
Spread the retainer with pliers and force the end of a screwdriver between the retainer and the drive shaft.
It is useful to grind the tips of the pliers so that they match the ends of the retainer. (Fig. 18)

Press the retainer off the drive shaft using the screwdriver.

Important note:
In order to avoid the danger of an accident, the retainer should be allowed to jump off the drive shaft only against a rag that is held as close to it as possible. (Fig. 19)



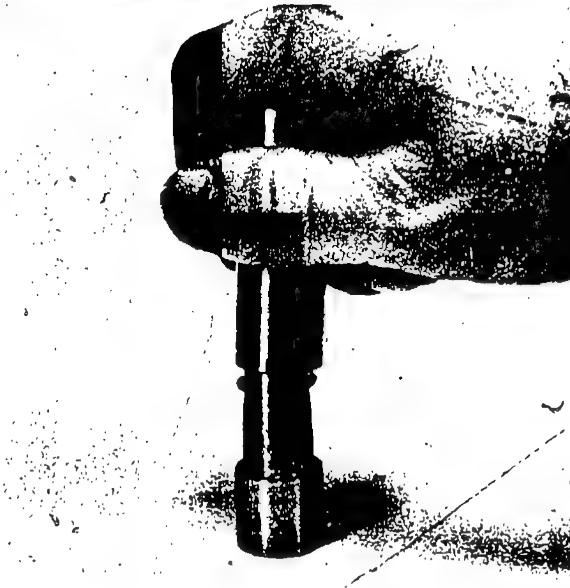
19

Fitting

These instructions should be inserted between Figs. 35 and 36 in VDT-WJP 161/4 B, i.e., before the text which starts "The two holes lying opposite one another...".

Use the tools manufactured locally according to Sketch No. 2, when fitting.

Press the retainer over the cone onto the sleeve. (Fig. 20)



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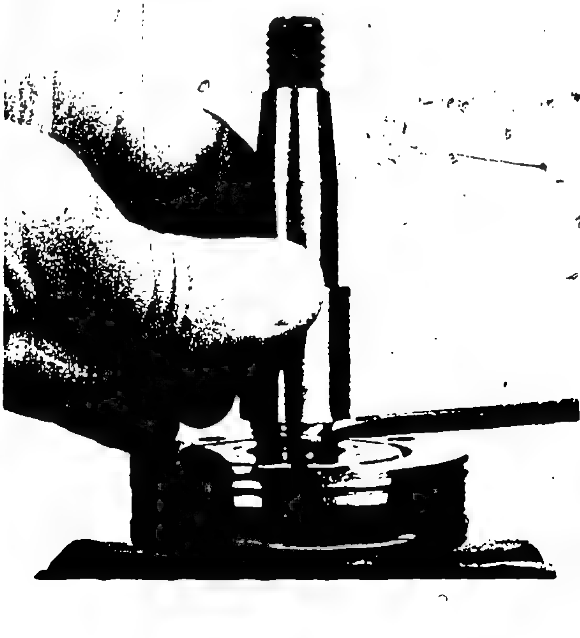
Slide the sleeve with the retainer onto the drive shaft. (Fig. 21)

Using a screwdriver, press the retainer off the sleeve and let it jump into the notch in the drive shaft. (Fig. 22)

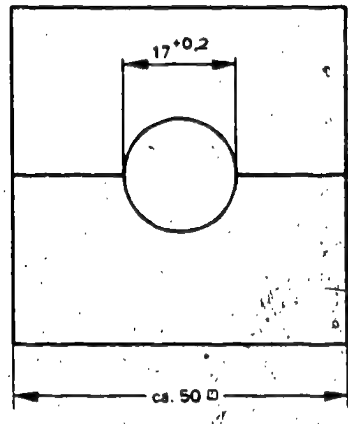


22

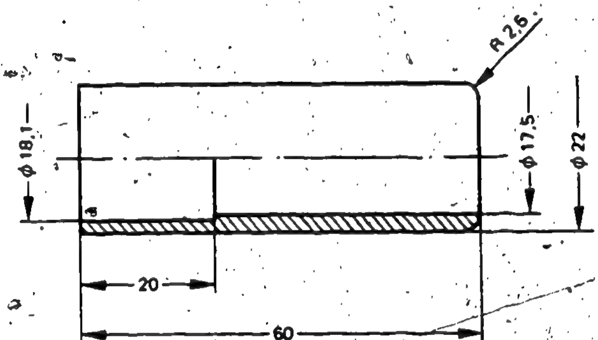
21

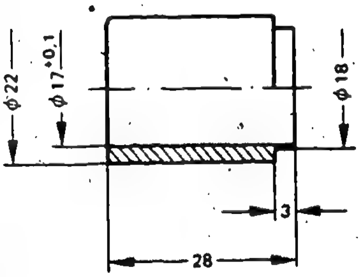
Special tool

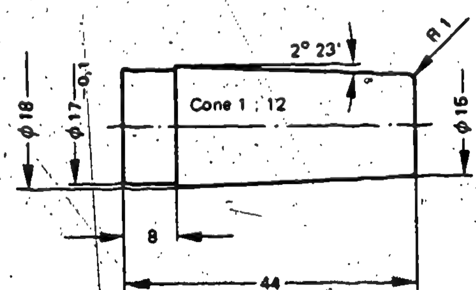
Protective sheet
Sketch No. 1
Material: Al
1 mm thick



Assembly tools
Sketch No. 2
Material: 9 S 20
Casehardened







ca. = approx.
ϕ = dia.

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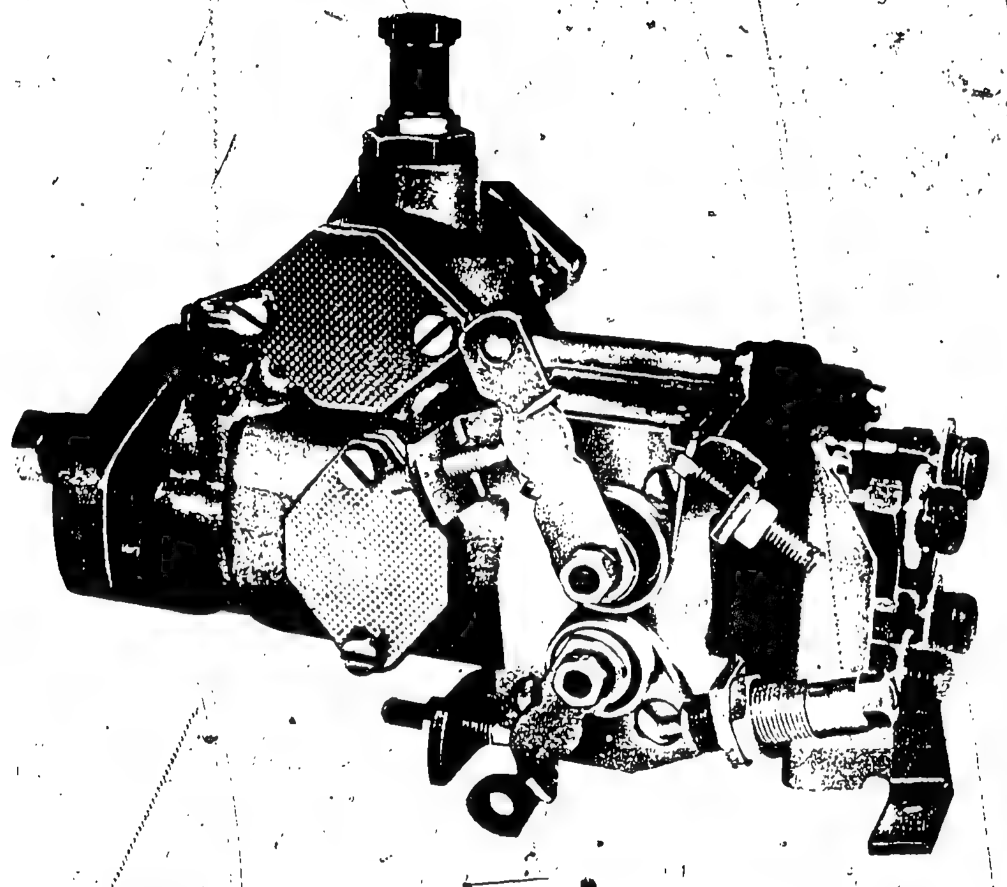
TEST INSTRUCTIONS
INSTRUCTIONS D'ESSAI
INSTRUCCIONES DE ENSAYO

EP

VDT-WPP 161/4 B, F/SP
Ed. 1



Distributor-type Fuel Injection Pump
Pompe distributrice d'injection
Bomba de inyección distribuidora

0 460 . .   EP/VA . . H . . C . .

E28

1. Test Equipment and Tools

Test equipment Tool	Part Number	Type Designation	Application Remarks
			Mounting of pump,
Flange	1 685 720 062	EFEP 157/8	50 mm (2 in) register
Flange	1 685 720 087	EFEP 157/13	46 mm (1 13/16 in) register
Test nozzle	0 681 443 014	EFEP 182	
Nozzle holder with test nozzle	1 688 901 000	EF 8511/9 G	adjusted to >150 kgf/cm² (2130 psi), one unit adjusted to 200 kgf/cm² (2840 psi)
Fuel injection tubing (6 x 2 x 840)	1 680 750 ..	EFEP 198..	See offer sheet VDT-AHF 295, Sheet 3 (4.69)
Testing device	1 688 130 075	EFEP 495 A	For measuring the supply pressure and supply pump pressure (pressure gauge set with fittings)
Measuring device	KDEP 1025	–	For measuring the timing device characteristics, with fitting for measurement of supply pump pressure.
Puller	KDEP 1027	–	For pulling out the clamping bushings of the pressure control valve.

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15 5. Herramientas auxiliares

BOSCH

Distributor-type fuel injection pump

TEST SPECIFICATIONS EP

VDT-WPP 001/4 B

Edition | Replacing

Special notes: Test instructions VDT-WPP 161/
For pre-adjustment see overleaf

Manufacturer:

Engine model:

Nozzle	EFEP 182	Test oil	Ol 61 v 11
Nozzle holder	EF 8511/9	Outside Germany Shell	Calibration fluid B or C
Opening pressure	150 kgf/cm² (2130 psi)	Test oil temperature	40 + 5° C (104 + 9° F)
Fuel-injection tubing	6 x 2 x 840 mm	Feed pressure	0.2 kgf/cm² (2.8 psi)

All test specifications apply exclusively to BOSCH fuel injection pump test stands and BOSCH test equipment.

Pre-stroke setting mm

1. CALIBRATION OF PUMP

	rev/min			Volume difference cm³
1.1 Timing piston travel			mm	
1.2 Supply pump pressure			kgf/cm² (psi)	
1.3 Full-load quantity			cm³/1000 strokes	
1.4 Low idle			"	
1.5 Start			"	
1.6 Break-away				

2. TEST SPECIFICATIONS and in brackets = (CHECK SPECIFICATIONS)

2.1 Timing device rev/min mm

2.2 Supply pump rev/min kgf/cm²

2.3 Delivery quantities

Speed-control lever	Delivery-rate control lever	rev/min	cm³/1000 strokes	Overflow quantity cm³/10 sec
Max speed stop	Full-load			
	Shut-off			
Idling stop	Full-load			

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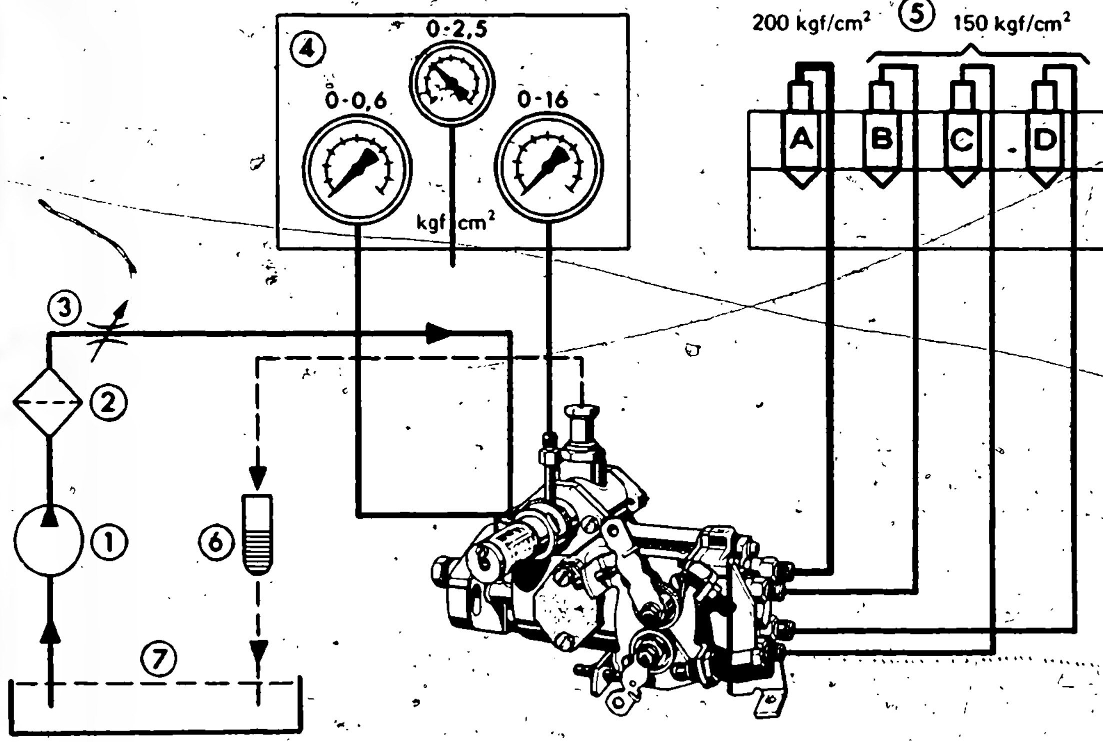
F2

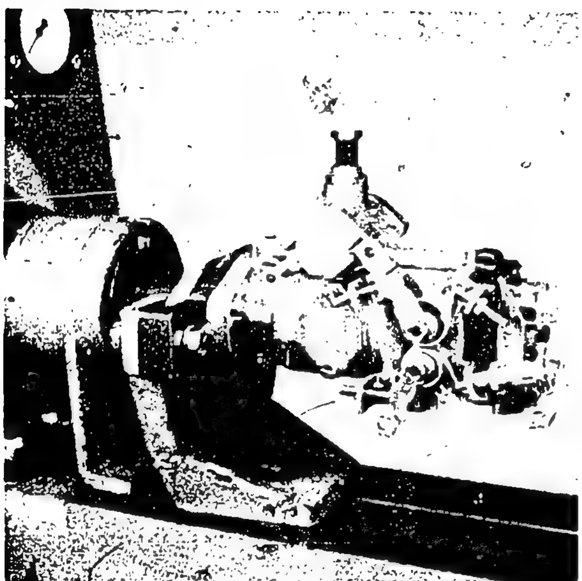
Pipeline diagram



1 = Fuel supply pump
2 = Filter
3 = Supply pressure regulator
4 = Pressure gauge 0 – 0.6 kgf/cm² (0 – 8.5 psi) (supply pressure)
0 – 2.5 kgf/cm² (0 – 35.6 psi) (charge pressure)
0 – 16 kgf/cm² (0 – 228 psi)
(supply pump pressure)
5 = Nozzle holder with nozzles 150 kgf/cm² (2130 psi)
Nozzle holder with nozzle 200 kgf/cm² (2840 psi)
at outlet A for start quantity
6 = Graduate for the overflow quantity
7 = Test oil tank

1 = Pompe d'alimentation
2 = Filtre
3 = Régulateur de pression d'arrivée
4 = Manomètres 0 – 0,6 kgf/cm² (pression d'arrivée)
0 – 2,5 kgf/cm² (pression de charge)
0 – 16 kgf/cm² (pression d'alimentation)
5 = Porte-injecteur avec injecteurs 150 kgf/cm²
Porte-injecteur avec injecteur 200 kgf/cm²
au départ A pour débit de démarrage
6 = Eprouvette graduée pour mesurer le débit de décharge
7 = Réservoir de fluide d'essai

1 = Bomba de alimentación
2 = Filtro
3 = Regulación de la presión de entrada
4 = Manómetro 0 – 0,6 kgf/cm² (presión de entrada)
0 – 2,5 kgf/cm² (presión de carga)
0 – 16 kgf/cm² (presión de la bomba de alimentación)
5 = Portainyectores con inyectores 150 kgf/cm²
Portainyector con inyector 200 kgf/cm²
en la salida A para el caudal de arranque
6 = Vaso de medición del caudal de rebose
7 = Recipiente de aceite de ensayo



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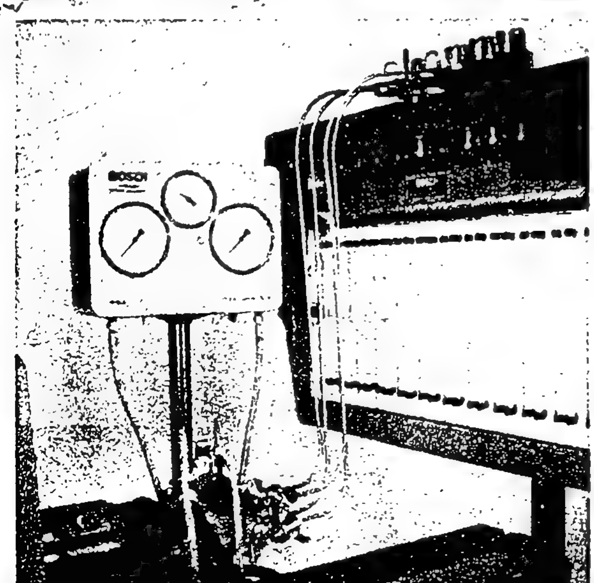

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2. Test Conditions

(see Pipeline Diagram)

Test oil 01 61 v 11 is used for testing at a temperature of 40 + 5° C (104 + 9° F) and a supply pressure of 0.2 kgf/cm^2 (2.8 psi) at all speeds.
Outside Germany "Shell Calibration Fluid B or C" can be used.
The overflow quantity at the overflow valve is returned to the test oil tank of the test stand through plastic tubing. The oil can be collected here in a graduate for measurement of the quantity of overflow.

2.1 Test equipment EFEP 495 A
is required for the following measurements:

Pressure gauge 0-0.6 kgf/cm^2 (0-8.5 psi) for measuring the supply pressure (built-in check valve for the protection of the pressure gauge) is connected to the supply inlet (supply pump inlet).

Pressure gauge 0-16 kgf/cm^2 (0-228 psi) for measuring the supply pump pressure is connected to the measuring device for measurement of the timing device characteristics.

2.2 Bend the fuel injection lines to the nozzle holders to permit stress-free connections. It is advisable to identify the lines with the letters stamped on the distributor head and to connect them to the nozzle holders in the sequence A, B, C, etc. (see pipeline diagram).
In some pump versions it is necessary to set one nozzle to 200 kgf/cm^2 (2840 psi), in order to measure the start quantity, and to connect it to outlet A. This measurement is specified on the appropriate test specification sheet.

3. Test Procedure for Readjustment

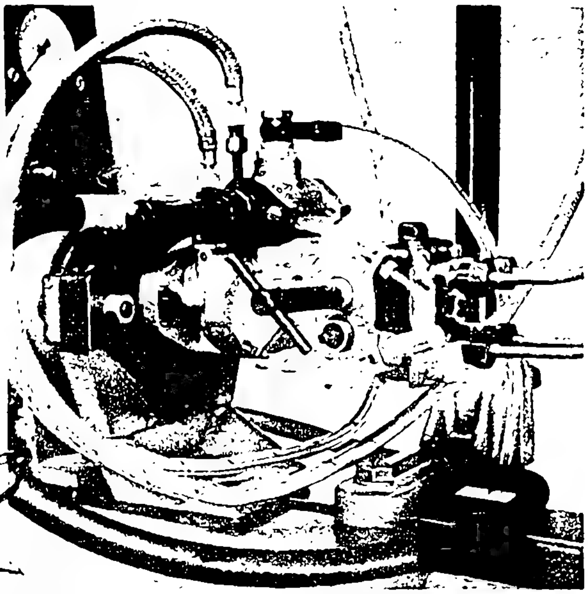
Mount pump (overflow valve at top)

Mount complete pump on mounting bracket on the test bench so that the coupling is under a tensile stress, i.e. mount pump on mounting bracket, loosen fastening bolt of mounting bracket; attach drive coupling of the pump with play-free coupling of the test bench. Pull mounting bracket with attached pump against drive. At the same time, tighten fastening bolt. Fig. 1

Connect test oil supply* and overflow tubing, fuel injection tubing with nozzle holders (150 kgf/cm^2 [2130 psi]; if need be, one nozzle at 200 kgf/cm^2 [2840 psi]) and pressure gauges. Mount measuring device for measurement of timing device characteristics opposite the spring side of the timing device.

*Test oil inlet is always at the same point independent of the direction of rotation (on the R.H. side when viewed from drive end).

Remove delivery-rate control and speed control levers. Adjust supply pressure. Operate pump at about 100 rev/min and vent at the test nozzle holders. Fig. 2



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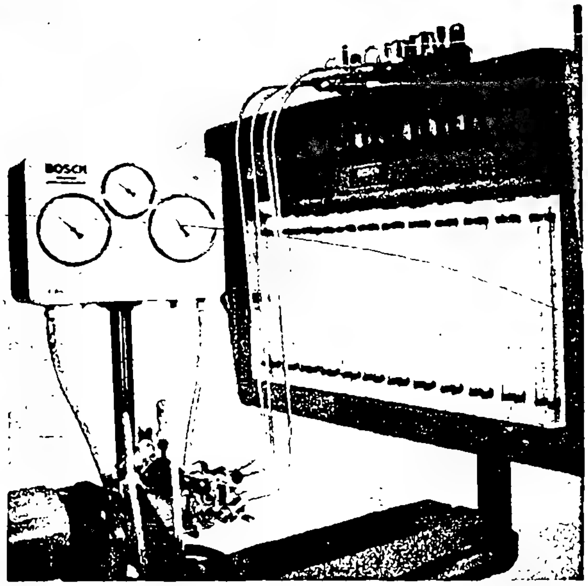
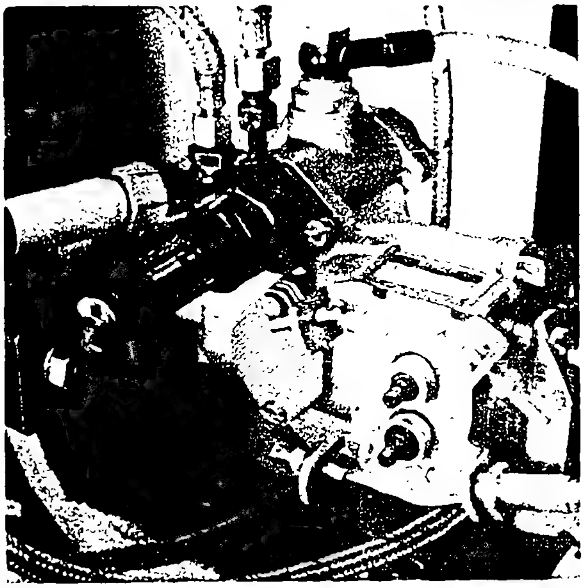
Operate pump at the highest speed given in the test specification sheet (Sect. 2.3). Fuel delivery must not be interrupted when speed is increased. Rotate throttle if this happens.
Turn throttle in the direction of idling stop until the delivery becomes noticeably smaller.



4

Breaking-in
Before making new settings, the pump must be broken in for about 20 min. Speed and quantity according to Sect. 1.3 of the test specifications.



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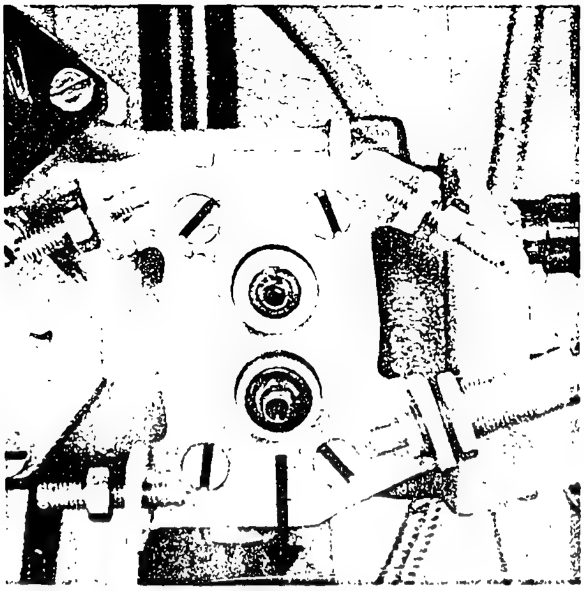
Adjust pump

See test specifications, Sect. 1, for calibration values.

Set timing piston travel according to 1.1 and the supply pump pressure according to 1.2.

At the specified speed, the timing piston travel and the supply pump pressure must be within the given tolerances. Setting is made on the pressure control valve.



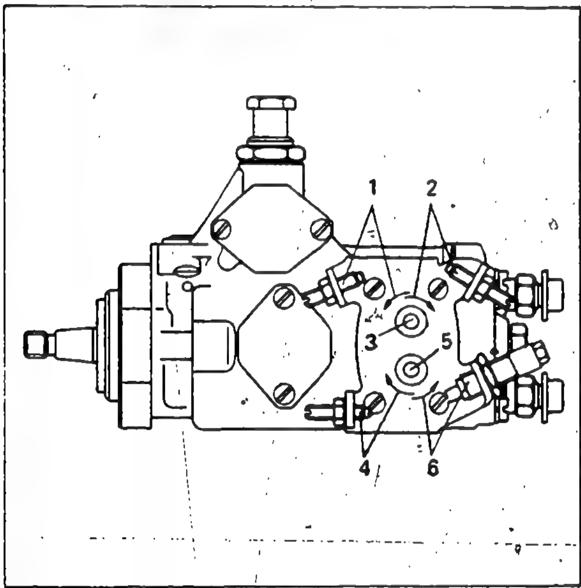
6

The use of the auxiliary tool (Sketch 1 on p. 13) sometimes will facilitate the following work sequence. We recommend fabrication of this tool.

Initial position of spill piston and throttle

The initial position of the spill piston is indicated when the notch points away from the throttle (see illustration).
The initial position of the throttle must be determined by turning it with the pump running (approximately idling speed) and with correctly positioned spill piston (notch pointing away from the throttle) until the correct quantity is delivered.
(If the throttle is rotated by 1/2 turn = 180° from this position, no delivery occurs).

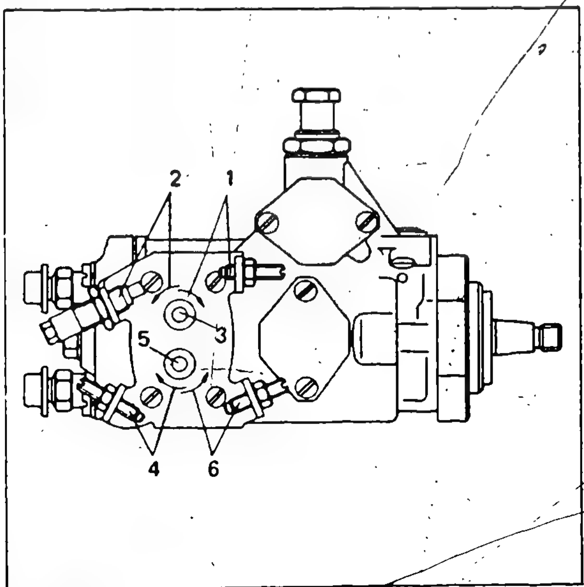
The possible installation arrangements shown in Figs. 7 and 8 for the spill piston and throttle and the stops are normal.
If the spill piston and throttle or the stops should be mounted elsewhere, the full-load position of the spill piston and the idling position of the throttle must be determined.
The full-load position of the spill piston is opposite the stop position.
The idling position of the throttle is opposite the maximum speed stop.



7

lever installation, right (viewed from drive side)

1 = direction of idling speed stop
2 = direction of maximum speed stop
3 = throttle (speed)
4 = full load stop direction
5 = spill piston (delivery rate)
6 = stop direction

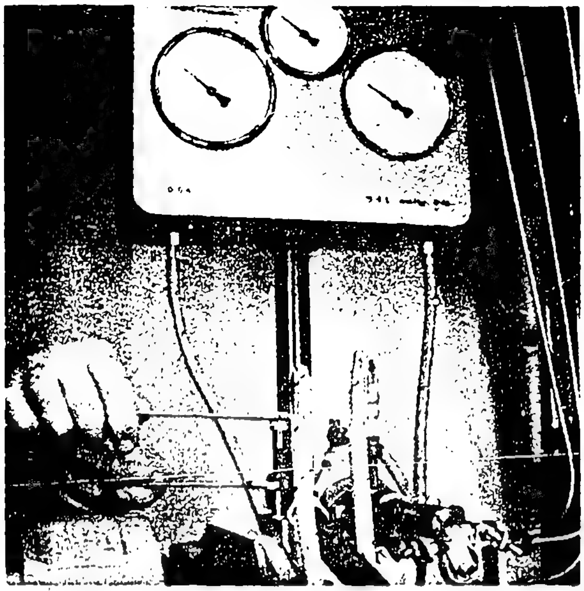


8

lever installation, left (viewed from drive side)

1 = full-load stop direction
2 = stop direction
3 = spill piston (delivery rate)
4 = direction of maximum speed stop
5 = throttle (speed)
6 = direction of idling speed stop

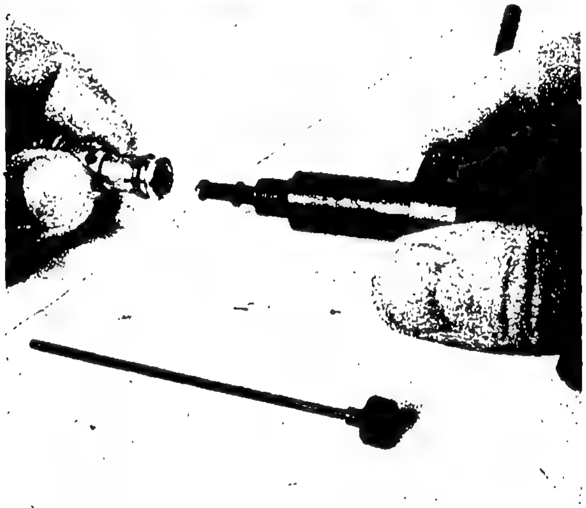
WPP 16114



9

By depressing the plug in the pressure control valve, the supply pump pressure is increased and the timing device characteristics are advanced. The mandrel shown in Sketch 2 on p. 13 can be used. Fig. 9

After pulling out the clamping bushing with the puller, the plug can be pushed back; in this way, the pressure can be decreased and the timing piston travel can be reduced.



10

The following work step is necessary:

Dismount pressure control valve (= one unit). Pull out clamping bushing with puller, dismount piston and spring, and push plug outwards. Reinstall spring and piston, press in clamping bushing until flush. Reinstall pressure control valve. Fig. 10 and 11

Setting the full load quantity

Operate pump at the speed specified in Sect. 1.3 of the test specifications and set the full-load quantity by rotating the spill piston to the specified value.
Rotation of the spill piston in the direction of full-load stop results in a larger quantity. Fig. 12

11

12

F7

Install delivery-rate control lever

Position spring and washer. Attach delivery-rate control lever.

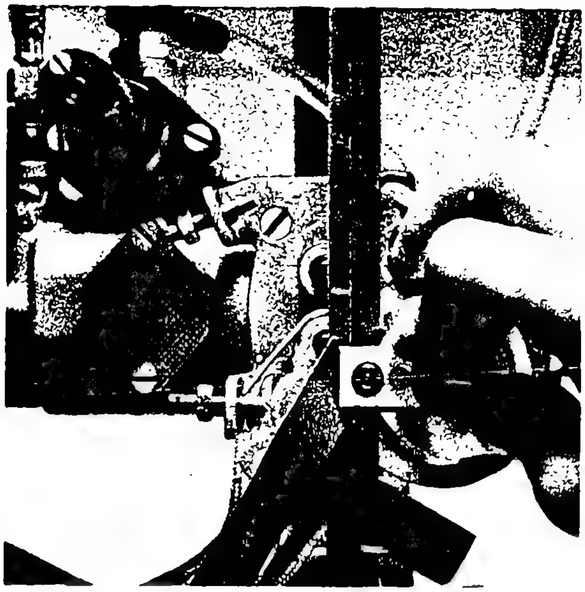
Installation position:

Push delivery-rate control lever onto the splines of the control shaft of the spill piston with consideration of the angle γ (see reverse side of test specifications). Do not turn the spill piston. Angle γ is the deviation of the delivery-rate control lever from the perpendicular in direction of the full-load stop.
If the lever cannot be installed in the specified tolerance range, another lever in which the gearing is offset by one-half tooth should be used. Fig. 13

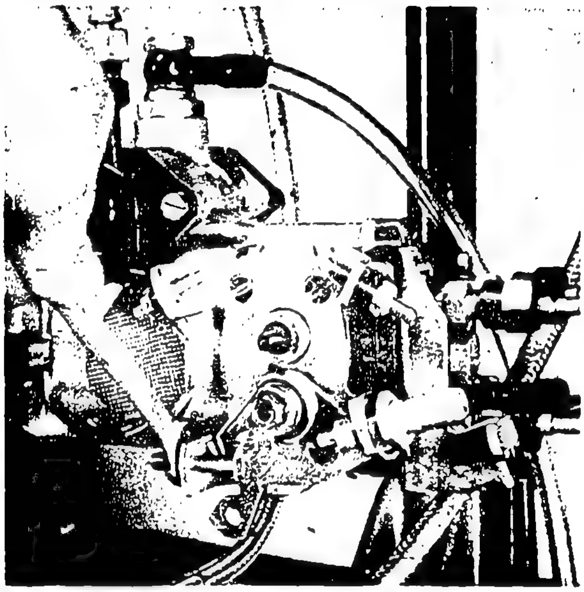
Let the full-load stop screw rest on the mounted delivery-rate control lever and secure it with a nut. Do not turn the spill piston. Attach delivery-rate control lever with nut and lock washer.
In pumps without spring-loaded stop, turn spill piston to stop position by means of the delivery-rate control lever and verify if zero delivery occurs at nominal speed.
If necessary, use a lever with gearing offset by one-half tooth*.
*Lever with punch marks is offset by one-half tooth compared to a lever without punch marks. Fig. 14
Place delivery-rate control lever against full-load stop screw.
Operate pump at the speed specified in Sect. 1.3 of the test specifications and set full-load quantity by turning the adjustable stop screw. Fig. 15

Setting of idling breakaway

Operate pump at the speed specified in Sect. 1.4 of the test specifications.
The delivery-rate control lever then rests on the full-load stop.
Turn throttle in the direction of the idling stop until the required idling quantity is reached. Fig. 16



13



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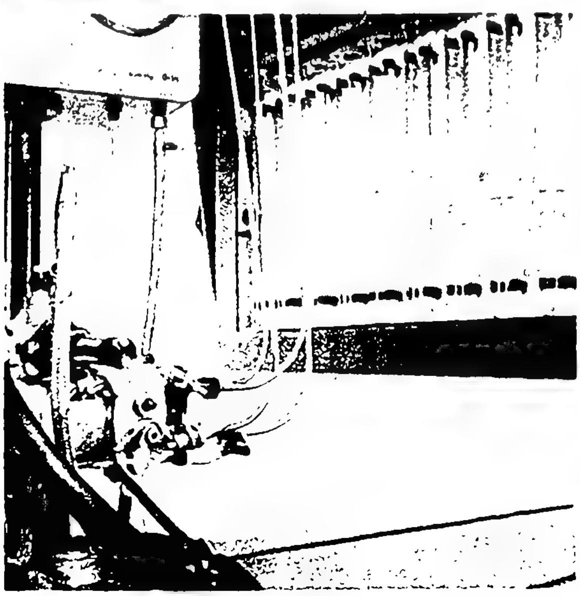

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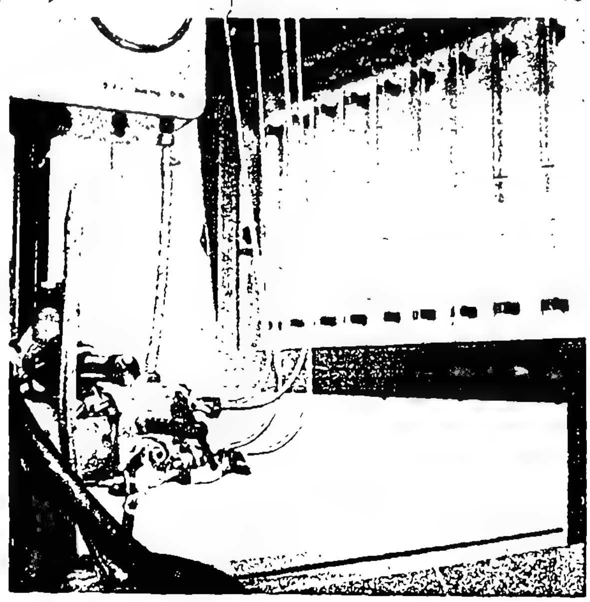
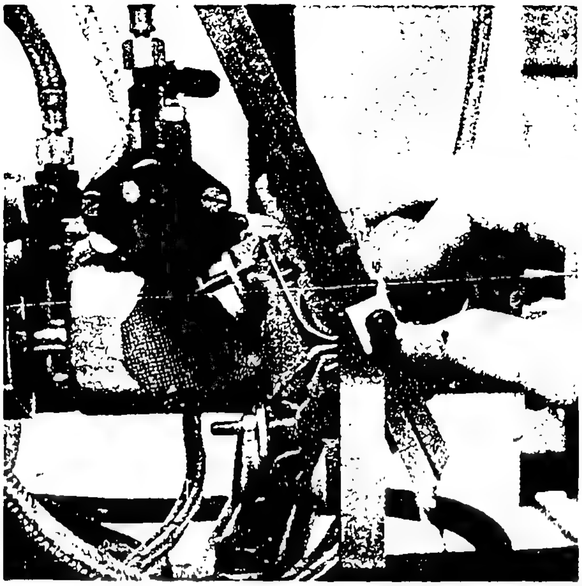


16

WPP 16114



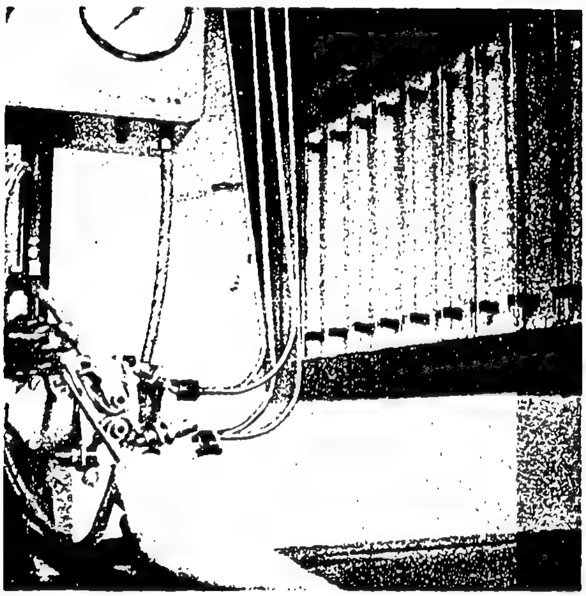
17

Install speed control lever

Position spring. Install speed control lever.

Installation position:

Push speed control lever onto the splines of the throttle control shaft with consideration of angle α (see reverse side of test specifications).
Do not turn the throttle.
The angle α is the deviation of the throttle from the perpendicular in direction of the idling stop.
If the lever cannot be installed in the specified tolerance range, another lever with a 1/2 tooth offset should be used. Fig. 17



18

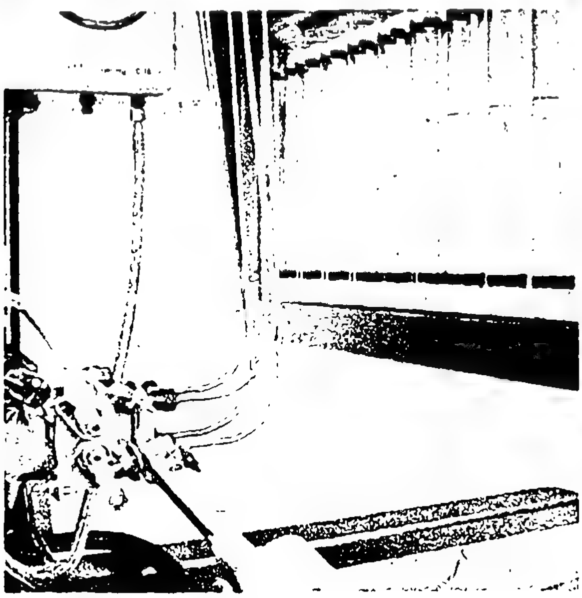
Let the idling stop screw rest on the installed speed control lever and lock the stop screw with a nut.
Do not turn throttle.
Install speed control lever with spring lock washer and nut.
Place delivery-rate control lever on the full-load stop.
Place speed control lever on the idling stop.
Operate pump at the speed specified in Sect. 1.4 of the test specifications and set idling quantity by rotating the adjustable idling stop screw. Fig. 18

Start Quantity

The pre-stroke, delivery valves and wear in the distributor-type pump influence the start quantity.

Adjust the mechanical start quantity

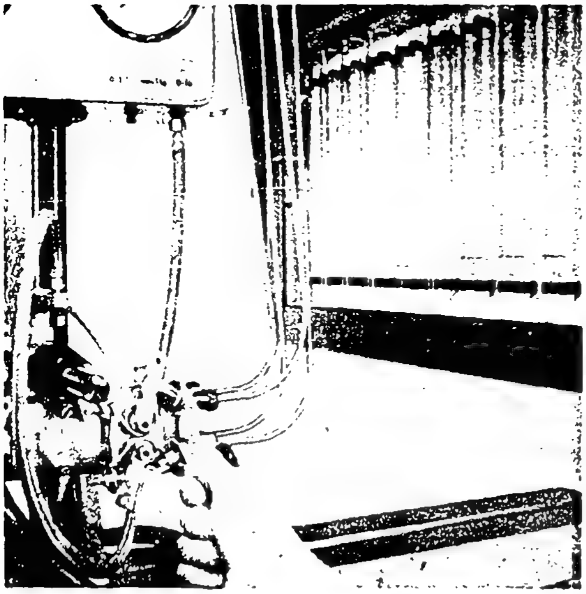
Operate the pump at the speed specified in Sect. 1.5 of the test specifications.
Note: In C-version pumps, the speed control lever does not necessarily have to be in idling position.
Slowly pull delivery-rate control lever in the stop direction until the start quantity is delivered just before the stop. Place spring-loaded stop on delivery-rate control lever (do not compress spring) and secure with nut. Measure the start quantity (only at 200 kgf/cm^2 [2840 psi] outlet, of specified). If necessary, correct by turning the adjustable stop screw.
In the stop position (= with delivery-rate control lever overdepressed by about 10°), verify if zero delivery is reached at nominal speed.
The angle δ is the total deflection of the delivery-rate control lever (full-load to stop). Fig. 19



19

Measure automatic start quantity

Operate pump at the speed specified in Sect. 1.5 of the test specifications.
Measure start quantity.



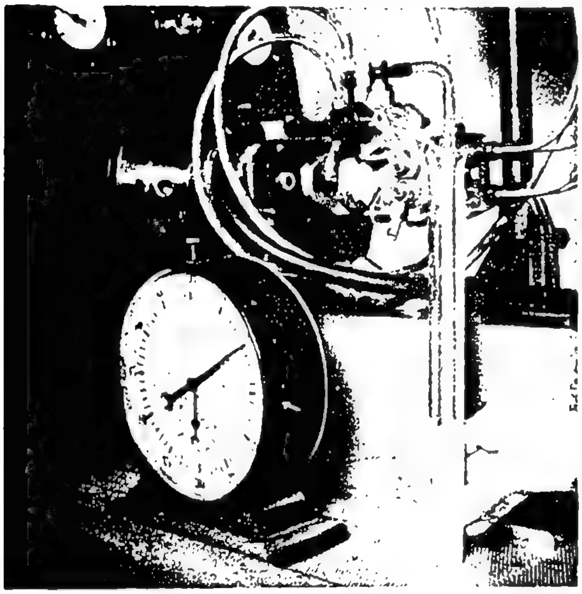
20

Setting the maximum speed breakaway

Place delivery-rate control lever on full-load stop.
Slowly increase the speed until the value specified in Sect. 1.6 in the test specifications is reached and at the same time, move speed control lever in the direction of maximum speed breakaway. Be careful that delivery does not stop.
Place adjustable stop screw on the speed control lever and adjust the fuel delivery quantity by rotating the adjustable stop screw.
The angle β is the total deflection of the speed control lever (Idling to maximum speed stop).

Test Pump

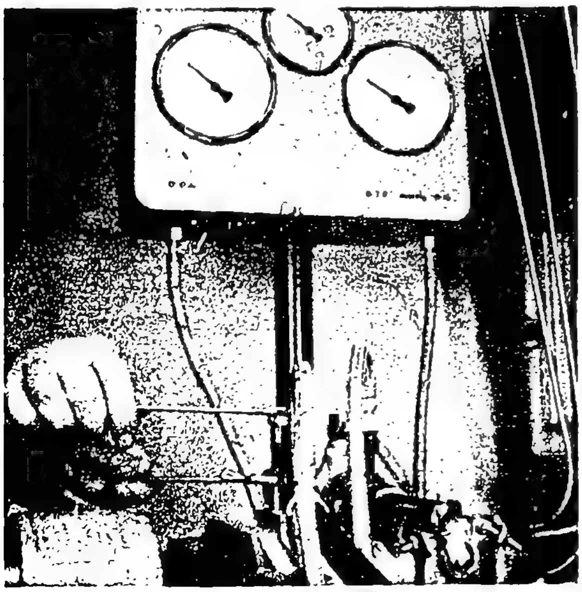
When testing the distributor-type pump only the values not in parentheses in Sect. 2 of the specifications apply.



21

Check the overflow quantity

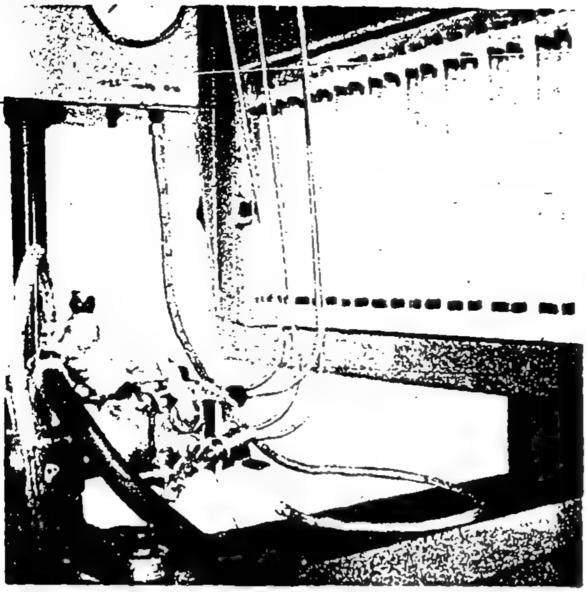
Operate pump at the specified speed. Collect the overflow quantity in a graduate and measure the volume. If the overflow quantity specified in the test specifications is not reached, the overflow valve should be replaced.



22

Check timing device characteristics and supply pump pressure characteristics

Place delivery-rate control lever on full-load stop and speed control lever at the maximum speed stop.
Check timing device characteristics according to Sect. 2.1 and the supply pump pressure characteristics according to Sect. 2.2 of the test specifications and if necessary reset within the tolerance (as described in the Section on "Pump Setting" on page 6).
Defects of the supply pump or pressure control valve affect the timing device characteristics and the supply pump pressure characteristics.
Defects in the timing device (for example, wrong spring) affect only the timing characteristics.
Disconnect measuring device for measuring the timing device characteristics as well as the pressure gauge hose.
Install cover; be careful to insert the rubber gasket correctly.



23

Check fuel delivery and break-away characteristics

Check the fuel delivery and break-away characteristics according to Sect. 2.3 of the test specifications.

Defects in the distributor head and delivery valves appear in the full-load delivery characteristics.
Defects in the timing device appear in the break-away characteristics.
Positions of the delivery rate control and speed control levers according to test specifications.
Do not read the 200 kgf/cm² (2840 psi) outlet in full-load and partial-load delivery quantity measurements.
Read start quantity only on the 200 kgf/cm² (2840 psi) outlet if indicated in the specification sheet.
The cut-in and cut-out point of the automatic start-quantity control is influenced by the supply pump pressure and can be corrected by changing this pressure. The correction must be within the tolerance range of the supply pump pressure and the timing piston travel.
Hook in springs for the delivery rate control and speed control levers.
Demount pump and attach seals.

4. Checking

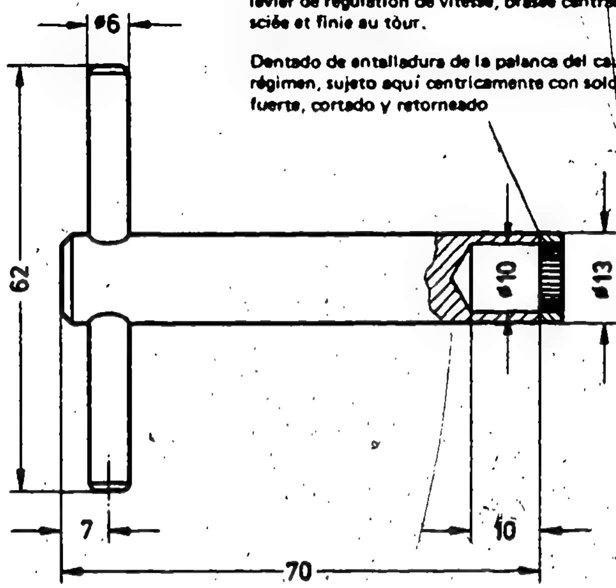
Only the values listed in parentheses in Sect. 2 of the test specifications are valid for checking a distributor-type injection pump.
Checking must follow the same sequence as testing (Sect. "Test pump" p. 11).
If the pump must be adjusted, the test values apply.

5. Auxiliary Tools
5. Outillage auxiliaire
5. Herramientas auxiliares

Splines (delivery rate control and speed control levers are centrally brazed, sawed off and turned).

Denture cannelée pour levier de régulation du débit ou levier de régulation de vitesse, brasée centralement, sciée et finie au tour.

Dentado de entalladura de la palanca del caudal o de régimen, sujeto aquí centricamente con soldadura fuerte, cortado y retorneado



Sketch 1

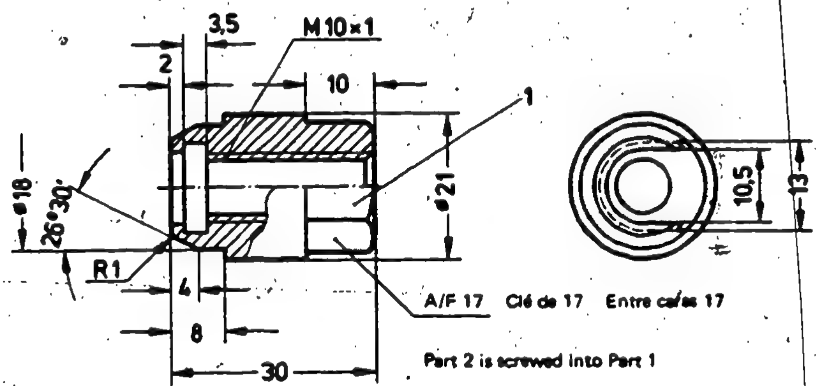
Auxiliary tool
Material: steel

Croquis 1

Outil auxiliaire
Matériau : acier

Croquis 1

Herramienta auxiliar
Material: Acero



A/F 17 Clé de 17 Entre caras 17

Part 2 is screwed into Part 1

partie 2 vissée dans la partie 1

Pieza 2 atornillada en la pieza 1

Sketch 2

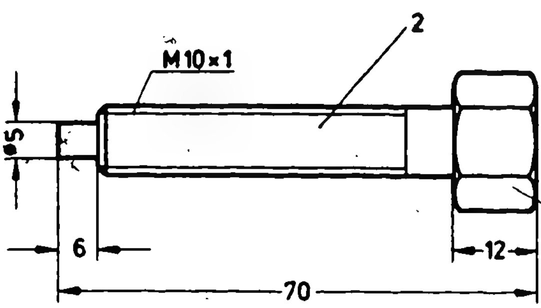
Mandrel
Material: steel

Croquis 2

Outil à emmancher
Matériau : acier

Croquis 2

Herramienta de calar
Material: Acero



A/F 17
Clé de 17
Entre caras 17

BOSCH

TEST INSTRUCTIONS

46

VDT-WPP 161/4 B Suppl. 1
Ed. 1

Distributor-type Fuel Injection Pump

0 460 . . EP/VA . . H . . C . .

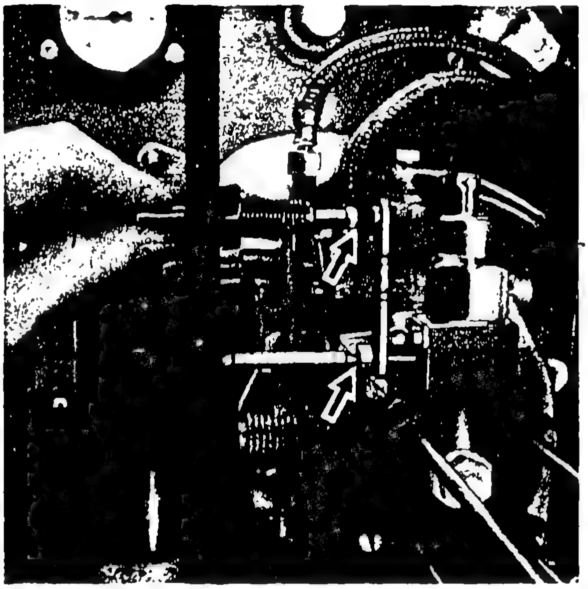
This supplement contains new developments which apply to the indicated sections of instructions VDT-WPP 161/4 B when testing distributor-type fuel injection pumps EP/VA..H..C..:

1. Setting and testing the idle breakaway of EP/VA..H..C..injection pumps with quiet-idle device.

2. Pressing the clamping sleeve into the pressure regulating valve.

1. Setting and testing the idle breakaway

When setting and testing the idle breakaway of EP/VA.. H..C.. injection pumps with quiet-idle device (called QD in the text) the QD must be switched on. The lever of the QD must be set at a certain angle and the speed control lever must be up against the idle stop.
Note: Do not remove QD lever.



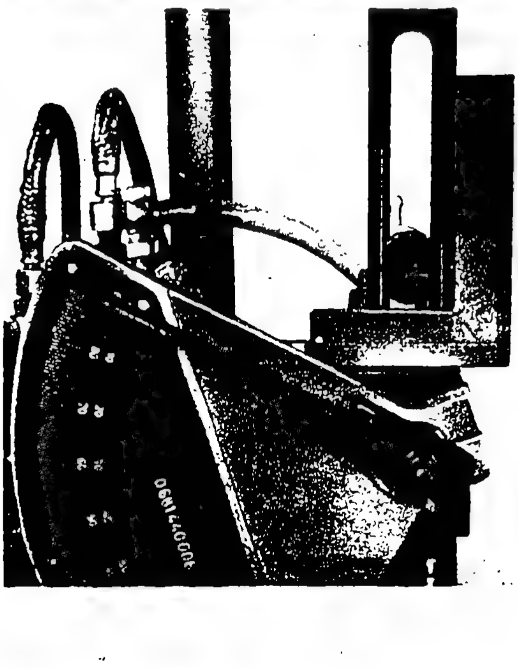
1

Setting the quiet-idle device

Remove bracket and retighten screws for hydraulic head.

For setting the angle of the QD lever, mount setting device 0 681 440 006 – EFEP 56 C on the test bench and align it with the QD shaft.

Align pin (manufactured locally according to Drawing 1) to QD ball-type bolt.



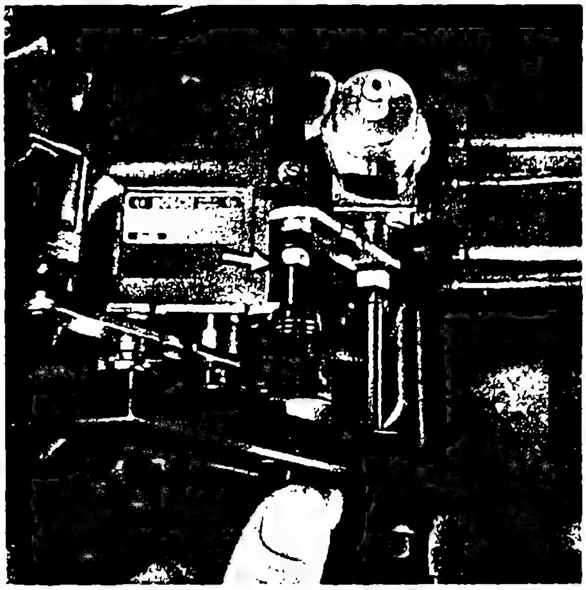
2

Set swivel arm of setting device vertically by means of a square. Set pointer of angle scale to "0". Set QD lever to the required angle, this is worked out by taking the number which is stamped on the QD and adding 5° (e.g. 21 (stamped number) plus 5 = 26° which is the required angle). This angle is the deviation of the QD lever from the vertical in direction of the speed control lever.

Set angle on setting device and clamp swivel arm.

Adjust QD lever until setting device pin is in alignment with the ball-type bolt when pressed up against it. Attach return hose to QD.

Set idle breakaway according to VDT-WPP 161/4 B then mount speed control lever and set stop.

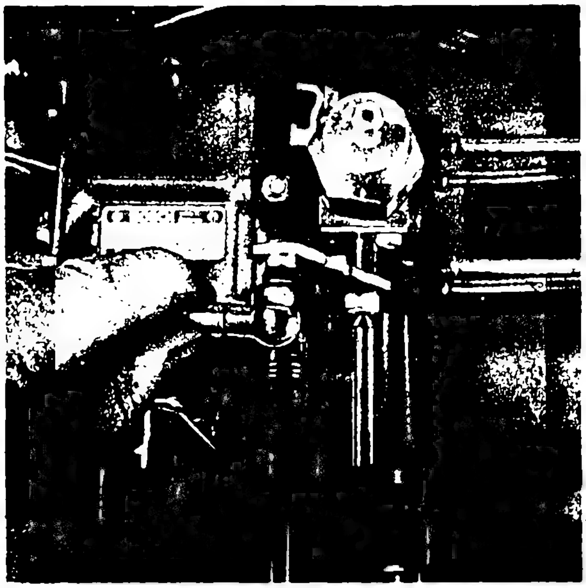


3

Fit linkage on ball-type bolt of speed control lever.

Press the pin against the ball-type bolt of the QD again. Speed control lever must be up against the idle stop. Adjust length of linkage so that the ball socket of the linkage can be pushed on to the ball-type bolt of the QD without changing the position to which the lever has been set.

Remove setting device.
Tighten screws of bracket with the prescribed torque.
Test breakaway again.

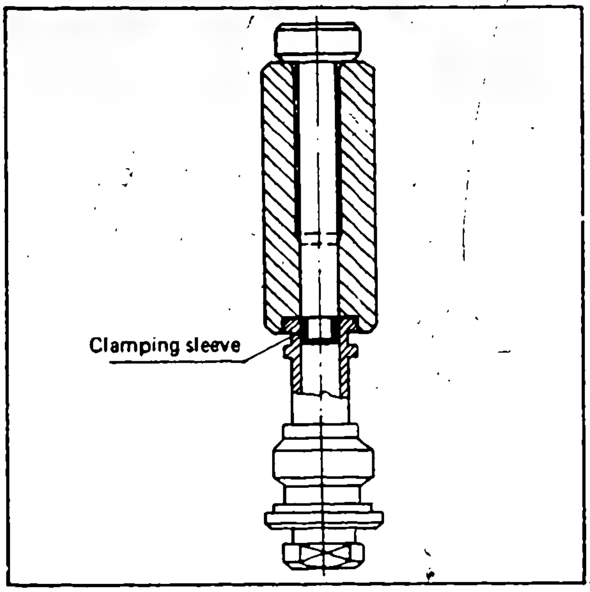


4

2. Pressing the clamping sleeve into the pressure regulating valve

In the text of instructions VDT-WPP 161/4, Ed. 1, page 10, paragraph "The following work step is necessary ", the sentence "Reinstall spring and piston, press in clamping bushing until flush " changes as follows:

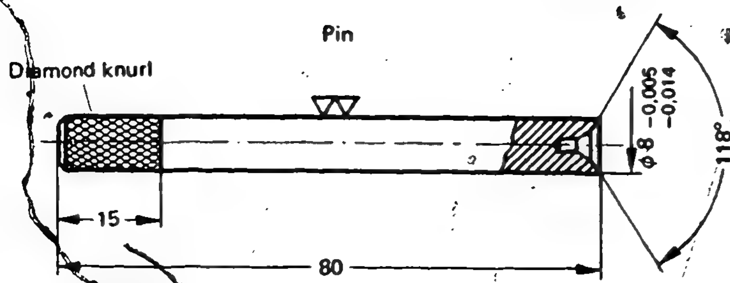
Reinstall spring and piston and, using tool manufactured locally according to Drawing 2, press in new clamping sleeve – see service parts list – until flush.



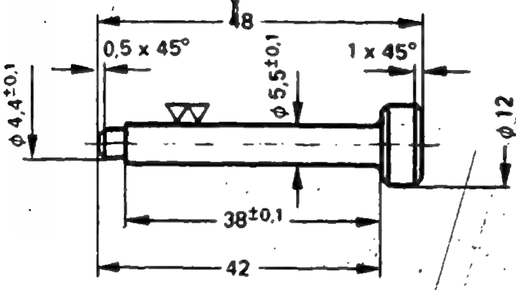
5

Seite 4

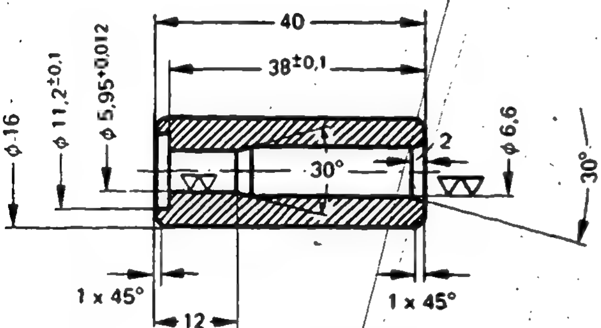
Pin



Drawing 1
Material: Steel



Drawing 2
Material: Steel



ϕ = dia.
All measurements in mm

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F16

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TEST INSTRUCTIONS
46

VDT-WPP 161/4 B Suppl. 2
Ed. 1

Distributor-type Fuel Injection Pump

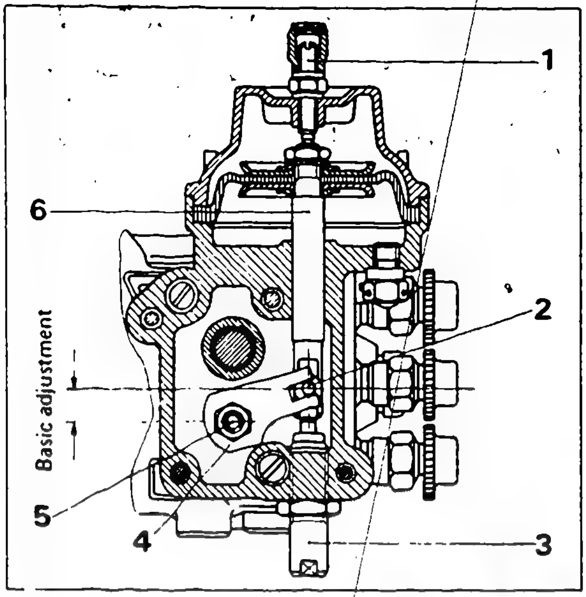
0 460 .. EP/VA .. H .. C ..
with Manifold Pressure Compensator

This supplement describes the procedure for testing the distributor-type fuel injection pump EP/VA..H..C.. with manifold pressure compensator.
The following points apply to the indicated sections of Test Instructions VDT-WPP 161/4 B:

1. Adjust and check manifold pressure compensator.

2. Measure automatic starting fuel delivery.

F17

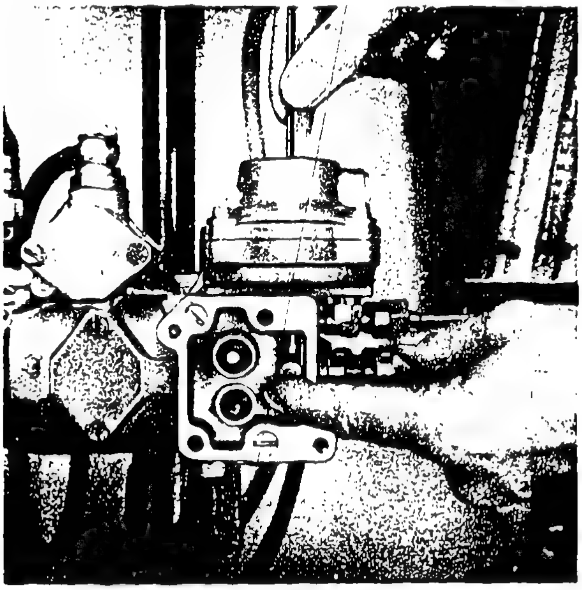


1

1. Adjust and Check Manifold Pressure Compensator

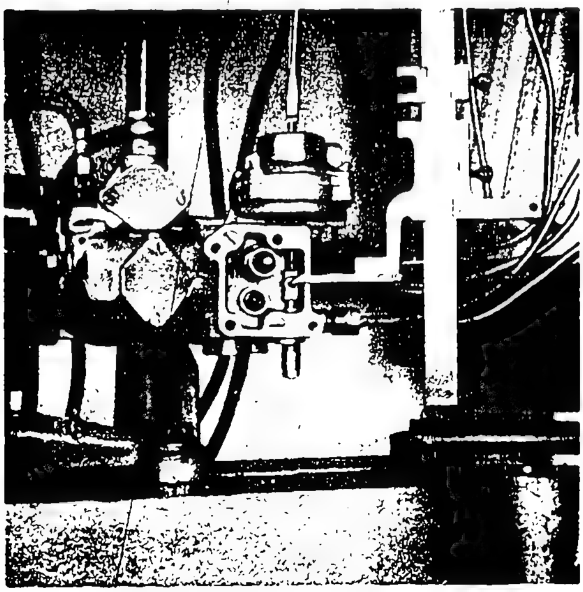
Replaces Figs. 12 to 15 and associated text in VDT-WPP 161/4 B.

Unscrew housing cover.
Remove adjusting screw (1), stop (3), and lever (4).


2

Check that the control rod (6) and the stop (3) can move freely.

Screw the adjusting screw (1) inward until it rests against the control rod (6); screw the stop (3) in for this purpose.


3

Using a commercially available calibrated scribing block, set the basic adjustment to 10 mm from the center of the governor control piston shaft (5) to the center of the bolt (2) by means of adjusting screw (1).

In order to support the calibrated scribing block, the base of the setting device 0 681 440 006 – EFEP 56 C can be mounted upside down on the test bench.

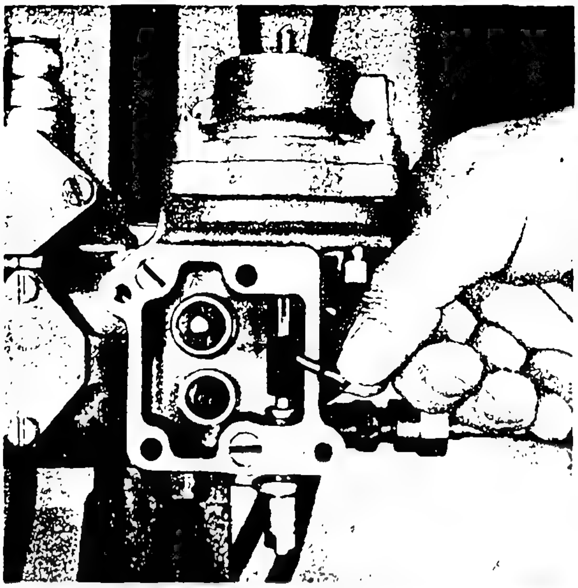
Adjust stop (3) for no play in its movement against the control rod and then turn it inward about 2 more turns.

Remove the washer and the bolt (2) with the retainer from the control rod.

Adjust the full-load delivery at the governor control piston according to point 1.3 of the Test Specification Sheet.

WPP 16114 S. 2
Seite 3

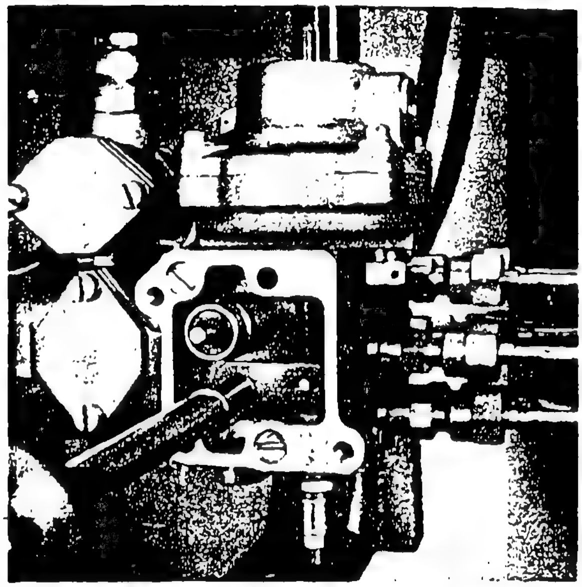
Insert the bolt (2) with the long guide section forward into the control rod.
Slide the washer onto the bolt.



4

Slide the washer onto the governor control piston shaft (5). Mount lever (4) and tighten it in place.

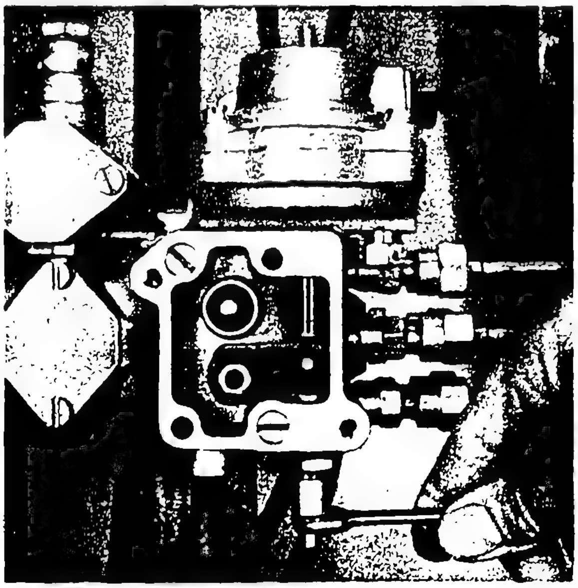
Check the full-load delivery again.
The full-load delivery can be corrected by shifting the control rod with adjusting screw (1).
Tighten the lock nut (gasket underneath!).
A deviation of ± 1.5 mm from the basic adjustment (10 mm) is acceptable and should be checked with the calibrated scribing block.
If the deviation exceeds the tolerances allowed, the lever (4) must be adjusted accordingly or replaced.



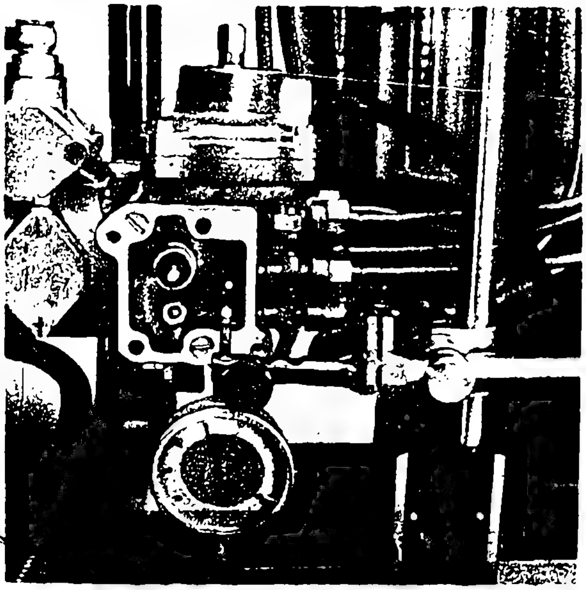
5

Connect the compressed-air line to the diaphragm housing. The regulating valve with throttle screw in vacuum gage 1 688 130 031 – EFEP 425 or 1 688 130 032 – EFEP 445 with a manometer 0 to 1.6 kgf/cm²) (quality class 1.0, scale graduations each 0.05 kgf/cm²) can be used to measure the pressure of the compressed air.

Leakage test of the diaphragm:
Mount the cap nut over the adjusting screw (1) with the gasket. Set the compressed air to a pressure of 1.0 kgf/cm². Close connection "2" to the regulating valve and stop the supply of compressed air. There must be no drop in pressure as shown by the manometer.



6



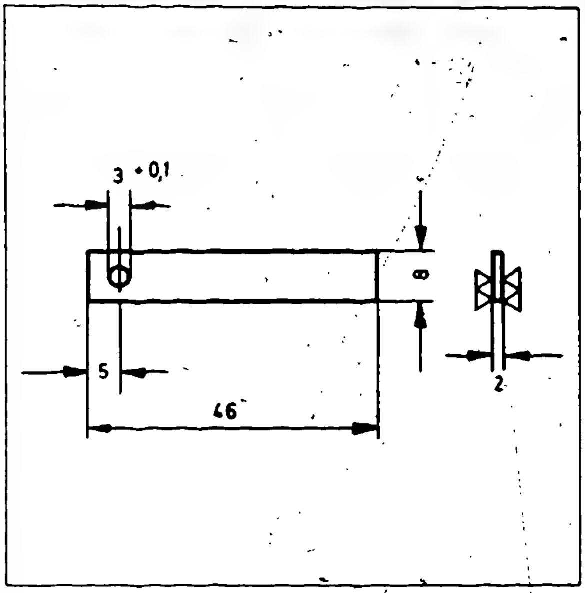
7

With stop (3) set the full-load delivery at maximum manifold pressure according to point 1.3 of the Test Specification Sheet and tighten the lock nut.

Check the other full-load points again.

Make the adjustment test of stop (3) according to the Test Specification Sheet using the dial indicator and dial holder.
EFEP 455/0/2 or a tool, locally manufactured according to Fig. 8 can be screwed onto the dial indicator as a measuring base.
Drive the injection pump at about idling speed.

Replace the housing cover with seal.



8

2. Measure the Automatic Starting Fuel Delivery

Special point to be noted in the text in VDT-WPP 161/4 B, Edition 1, Page 12, under "Measure Automatic Starting Fuel Delivery":
Place the speed control lever against the end stop.

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After-sales Service Instructions

Repair instructions

46

VDT-W-460/101 En
Ed. 2
replaces VDT-WJP 161/4 – Suppl. 3

Distributor-type fuel-injection pump 0 460 . . VA . . H . . C . .

Simplified measuring method

BOSCH After-sales Service Automotive Equipment

F21

This publication has been redesigned with the forthcoming change-over to microfilm in mind.
When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a printed-publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.
Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Contents

1. Tools
2. Measuring the governor spring chamber
3. Measuring the electrical shut-off spring chamber

Published by: After-sales Service Department for Training and Technology (KH/VSK). Please direct questions and comments concerning the contents to our authorized representative in your country.

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(6.1979)

F22

1. Tools

Measuring tool KDEP 1023 for measuring length: force ratio
Measuring tool KDEP 1094 for measuring the governor springs
Measuring tool KDEP 1095 for measuring the electrical shut-off spring chamber

2. Measuring the governor spring chamber

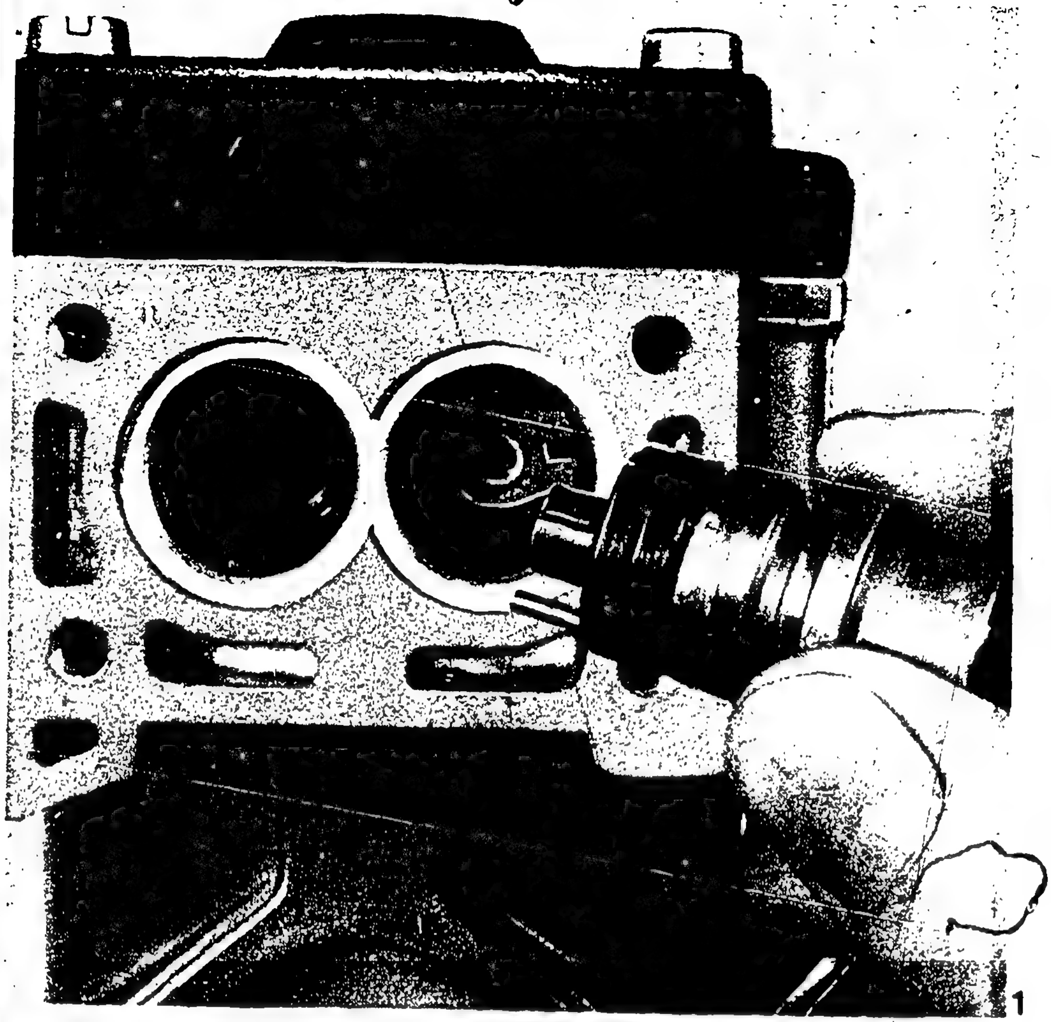
These instructions replace Figs. 54 to 57 and the associated text in VDT-WJP 161/4 B.

The remarks associated with Fig. 54 from "Setting the governor spring": through "Push the control spool up against the mechanical stop." continue to apply.

Initially, do not fit O-rings on the shaft and on the bushing of the delivery rate control device. There should be no shim on the shaft.

Insert the shaft into the bushing.
Note the washer between the shaft and the bushing.

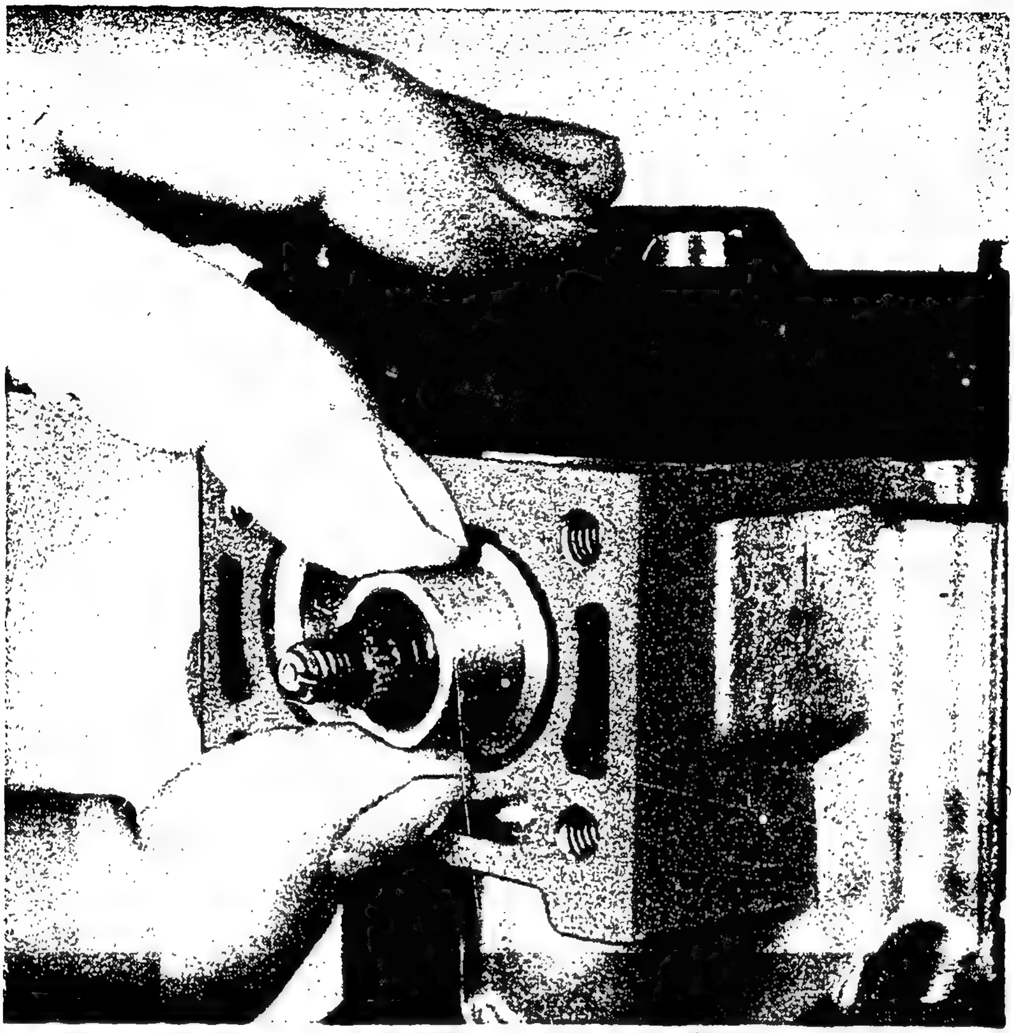
Set the measuring tool KDEP 1094 to an overall length of about 2 mm longer than dimension V given in the Test Specifications Sheet.


1

Insert the measuring tool KDEP 1094 instead of the control spring into the shaft.

Insert the bushing, shaft, and tool, with the slotted bushing forward, into the delivery rate control device port.

W - 4601101
Seite 3



2

Press only the bushing against the hydraulic head and control spool, which is resting against the mechanical stop, until the shoulder of the bushing rests against the pump housing.

Pressing on the shaft will result in an incorrect measurement.

Note:
The drive pin on the shaft must not press against the control spool.

3

Remove the bushing, shaft, and tool.

Remove the tool from the shaft and measure its length.

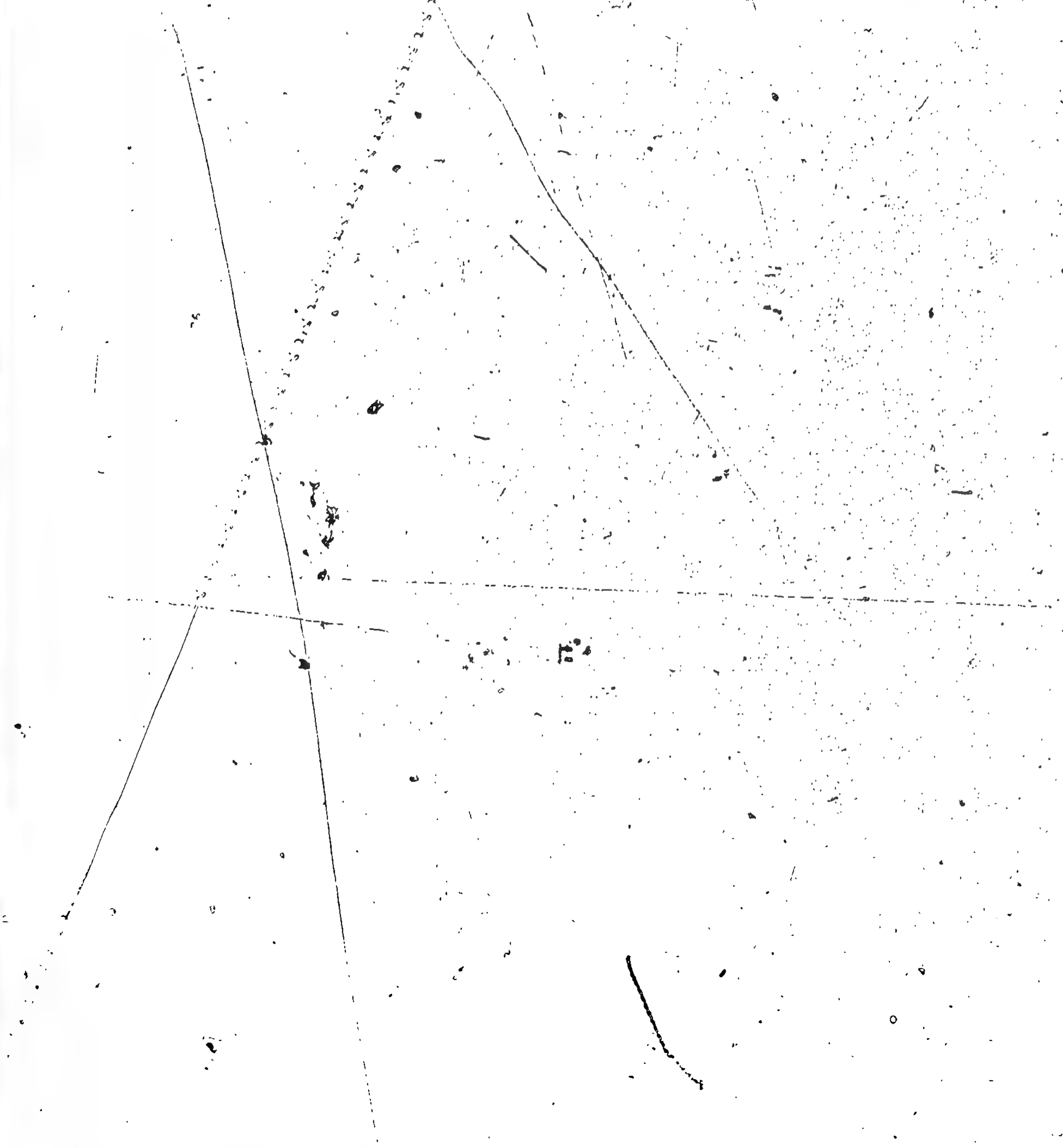
Compare the dimension measured with the specified dimension (dimension V – Test Specifications Sheet), and compensate for the difference with suitable shims.

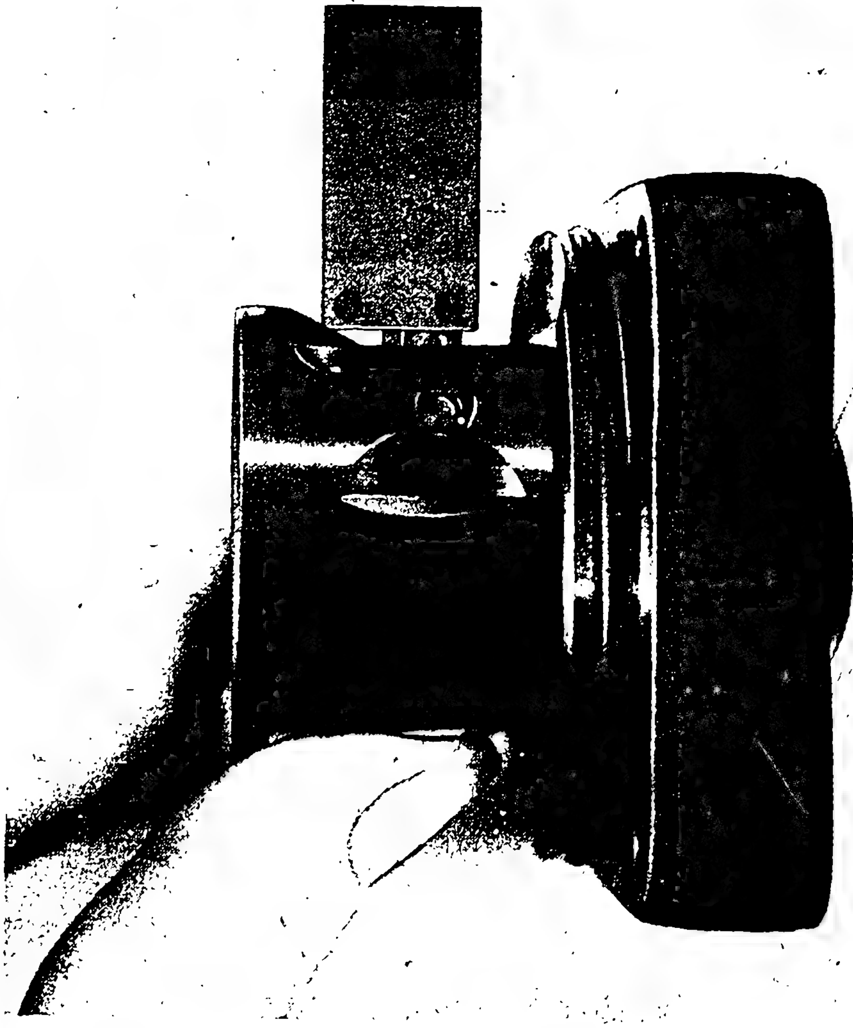
Place O-rings on the shaft (with assembling sleeve) and on the delivery rate control device bushing.

3. Measuring the electrical shut-off spring chamber

These instructions replace Figs. 8 to 11 and the associated text in VDT-WJP 161/4 B, Supplement 1.

The introductory remarks in Section d) "Electrical Shut-offs" from the beginning of the section through "This spring must be installed with a given initial tension" and the concluding remarks from "All other operations..." continue to apply.





Measure the length of the shut-off stroke at the hydraulic head with a depth gauge. Press the throttle in to its rest position for this measurement. The throttle projects out from the hydraulic head by the length of the shut-off stroke.

W-4601401
Seite 4

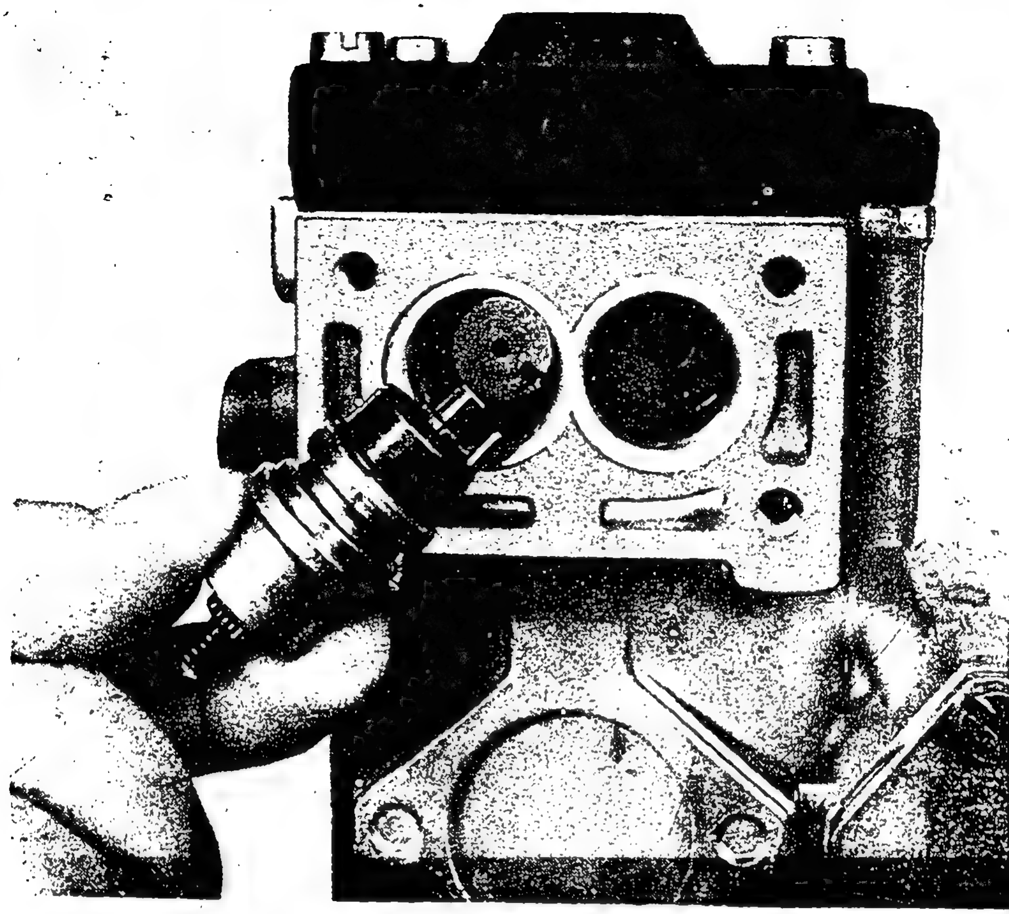
5

Initially, do not fit O-rings on the shaft and on the bushing of the speed control device.
There should be no shim in the shaft.

Insert the shaft into the bushing.
Note the washer between the shaft and the bushing.

Insert the measuring tool KDEP 1095 with the slotted bushing forward, into the shaft.

Set the tool to an overall length so that its pin is aligned with the pin of the shaft.

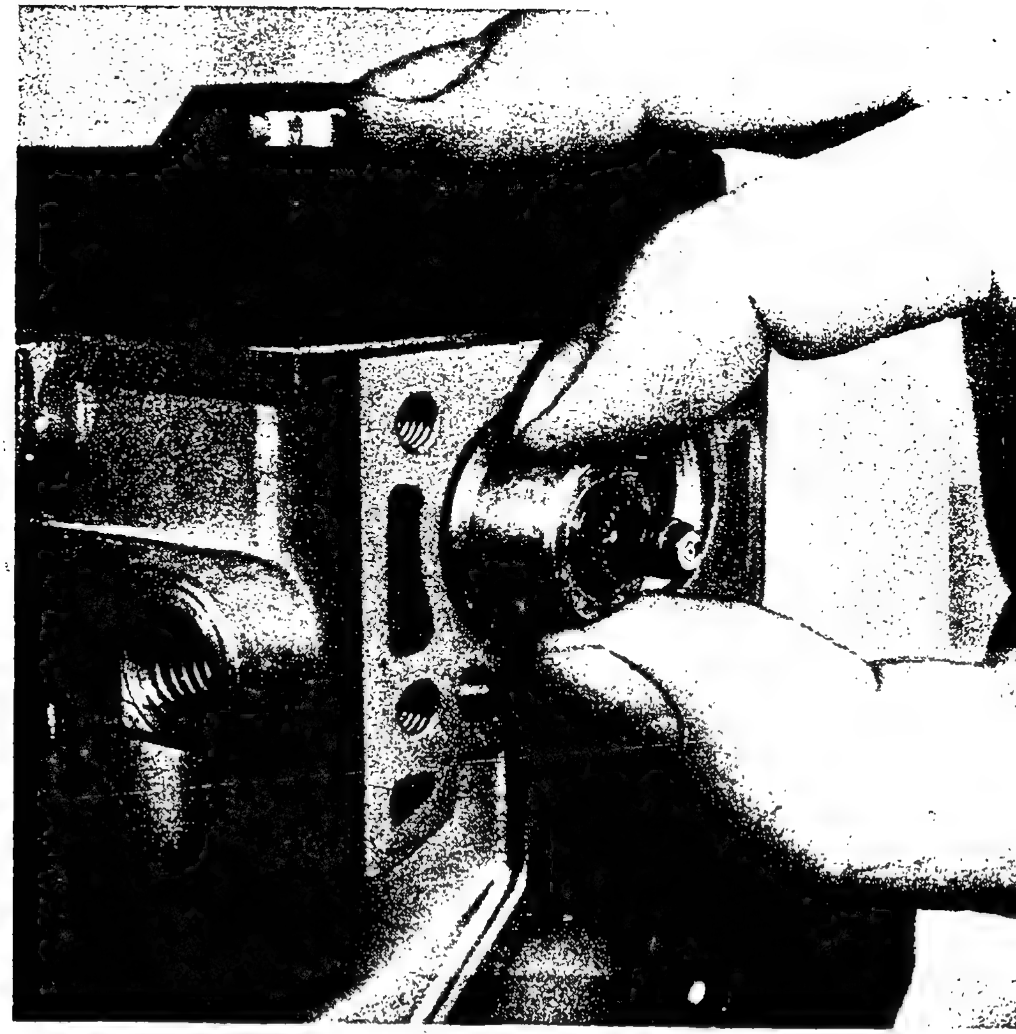


6

Press the throttle all the way into the hydraulic head.

Insert the bushing, shaft, and tool into the speed control device port.

Be sure that the drive pin on the shaft engages the drive notch in the throttle.



7

Press only the bushing against the hydraulic head until the shoulder of the bushing rests against the pump housing.

Pressing on the shaft will result in an incorrect measurement.

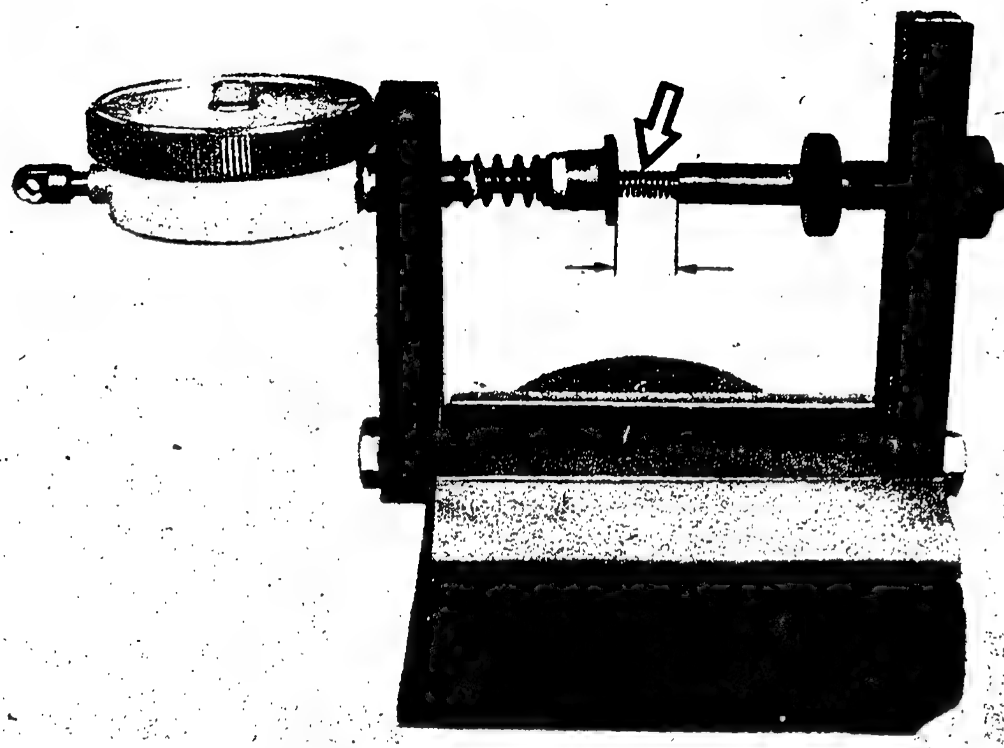
8

Remove the bushing, shaft, and tool.

Remove the measuring tool KDEP 1095 from the shaft and measure its length.

Place O-rings on the shaft (with assembling sleeve) and on the speed control device bushing.

W-4601/101
Seite 5



9

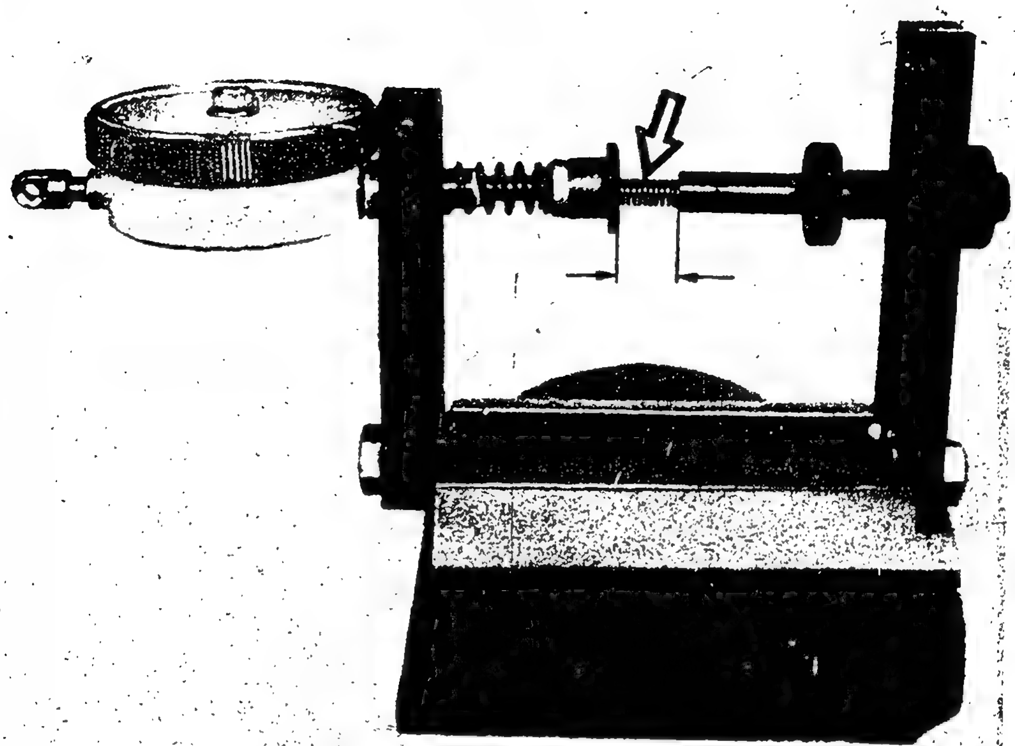
Measuring the length: force ratio of the electrical shut-off spring.

Clamp the measuring device KDEP 1023 with the spring tester in a vise.

Set the unloaded spring tester to "0".

Insert the pressure spring between the spring tester measuring sleeve and the adjusting pin of the measuring device.

Press the spring against the spring tester measuring sleeve by turning the adjusting pin until the prescribed spring pre-load given in the Test Specifications Sheet is indicated.
Tighten the lock nut of the adjusting pin.



9

Measure the length of the pre-tensioned compression spring with the caliper gauge between the measuring sleeve of the spring tester and the adjusting pin **(the spring tester must not be compressed).**

Remove the pressure spring from the measuring device.

Calculate the difference between the dimension read on the caliper gauge and the calculated length of the measuring device KDEP 1095.

Compensate for the difference with suitable shims.

Jamming of Pressure Regulator in Opel Passenger Cars

with EP/VA . . H . . CL 163 . . .

46

VDT-I-460/101 B
2.1977

We are occasioned to point out that the following defects may arise in Opel diesel-powered cars with EP/VA..H..CL 163.., date of manufacture 625...632:

Poor performance, blue smoke

Black smoke.

A possible cause is jamming of pressure regulator 1 460 362 027.

Remedy:

Remove pressure regulator 1 460 362 027 using socket wrench KDEP 1086.

Pull out the slotted spring pin using puller KDEP 1027.
(See Test Instructions VDT-WPP 161/4 page 8, Fig. 11)

Remove the plunger by tapping lightly on the workbench or vise.

Remove the helical compression spring.

All components must be washed clean with a cold cleaning solution.

Lubricate all parts with calibrating oil prior to reassembly.

Install the helical compression spring and plunger, checking the plunger for freedom of movement.

Press in a new slotted spring pin 1 460 224 001 using an auxiliary tool to be user-fabricated. (See Test Instructions VDT-WPP 161/4 1st Supplement, Fig.5).

Install the pressure regulator and tighten with the specified torque of 8...9 N·m (0.8...0.9 kgf·m).

Caution!

The valve setting, i.e. position of the plug in the valve holder, should not be altered.

Should this nevertheless happen, the internal pump pressure must be readjusted on the test bench.

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TIMING-DEVICE MODIFICATION VDT-I-460/121 En

on VA 6/100 F 1000 CR 199 or CR 199 P 2.1981

(IHC engine D 310)

In order to prevent misfiring and the formation of white smoke on International Harvester tractors fitted with the D 310 engine, the VA 6/100 H 1000 CR 199 and the CR 199 P distributor-type fuel-injection pumps have been modified by increasing the timing-device adjustment range by 3°.

Until FD 922 (date of manufacture Feb. 1979), the timing-device piston was adjusted with a setting of 3° "advance". In order to shift the nominal start of pump delivery to 6° "advance", a shim was fitted between the spring cover of the timing device and the housing. A different spring (Item No. 26 on the Service Parts List, Part Number 1 464 618 005) was also fitted. These modified pumps are marked as follows: VA...CR 199 A or CR 199 PA:

As from FD 922, distributor pumps are delivered ex-works with the timing-device piston and the spring (but without shim) already set to 6° "advance". Modified distributor pumps with the code VA 6...199A which are received by service stations and which require a thorough overhaul, must be fitted with a new housing and new timing-device piston (Part Number 1 456 120 983) whereby the shim is to be removed.

Warranty:

Costs are to be borne by the customer. Warranty claims cannot be accepted.

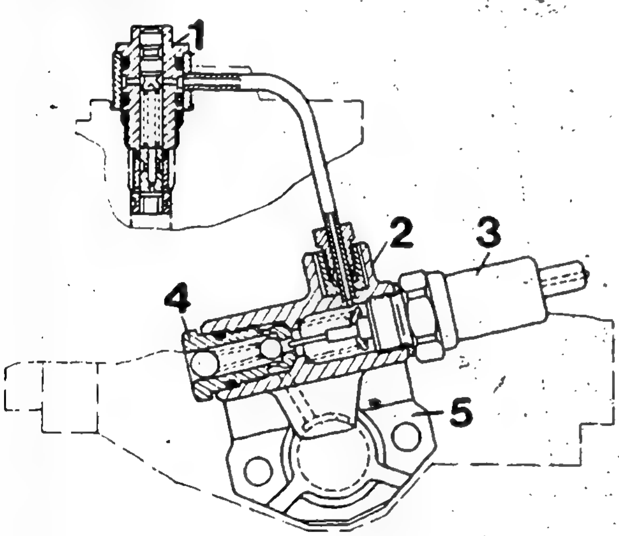
NEW PRODUCT VDT-I-460/5 En

Distributor-type fuel-injection pump VE..F.. 11.1982
with hydraulic cold-start accelerator (KSB)

General

For a better cold start and consequent running-up of the diesel engine, it is an advantage if the injection timing point can be advanced.
However, this must only be done with a cold engine.
The shifting of the injection timing point in the "advanced" direction is carried out with a hydraulic cold-start accelerator (KSB).

Construction of the hydraulic cold-start accelerator (KSB) with its main components



1 = pressure regulator
2 = pressure maintaining valve
3 = expansion element
4 = ball valve
= KSB valve

The cold-start accelerator contains two component groups

- Pressure regulator
- KSB valve

These are connected with an electric cable.
An electrically-heated expansion element is fitted in the KSB valve. The expansion element controls the pressure.

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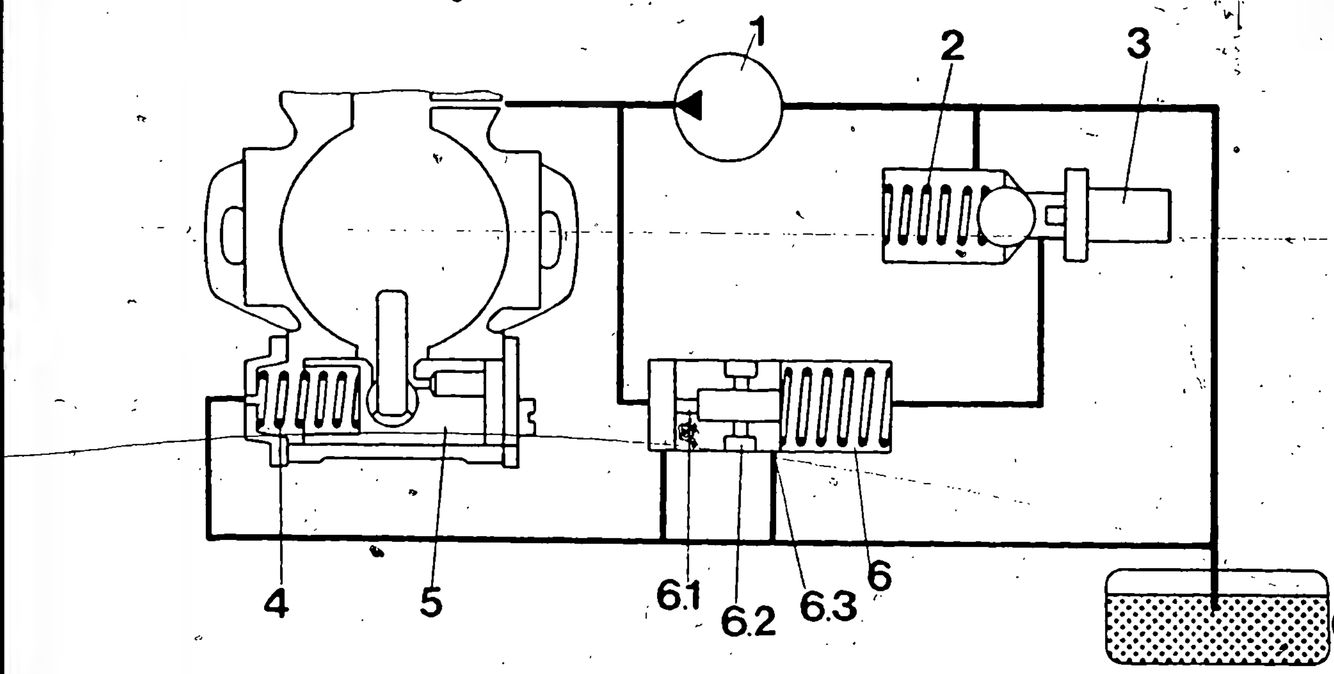


1 = supply pump
2 = pressure maintaining valve
3 = expansion element
4 = timing-device spring
5 = timing-device piston
6 = pressure regulator
6.1 restriction bore
6.2 ring groove
6.3 cross hole

Method of operation

The supply pump (1), controlled by the pressure regulator (6), creates a pressure dependent on the engine speed.
This pressure causes the timing-device piston (5) to press against the timing-device spring (4) and the start of injection is adjusted in accordance with the engine speed.

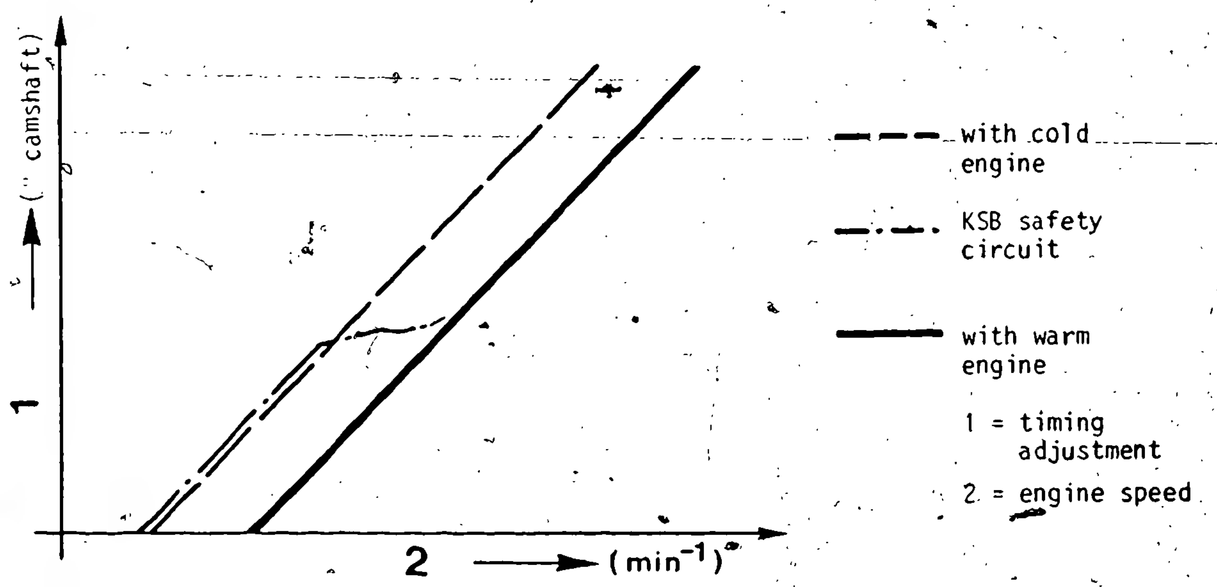
During a cold start the injection timing point is moved in the "advanced" direction. This move is carried out as follows:

The piston in the pressure regulator (6) has a restriction bore (6.1) along its length, through which a certain quantity can flow to the KSB valve.
When the engine is cold the pin of the expansion element (3) is lifted from the ball valve (2). This means that this quantity must open the ball valve in order to flow away.
To do this the opening pressure of the ball valve must be overcome.
This additional pressure affects the spring side of the piston in the pressure regulator (6), which results in a correspondingly higher pressure on the timing-device piston and in a certain movement in the "advanced" direction.

When the engine is started, the heating of the expansion element is switched on at the same time.
If, after starting, the engine has reached a sufficient operating temperature, the expansion element expands and the pin opens the ball valve.
The pressure on the spring side of the piston in the pressure regulator drops and the advance movement of the timing device is switched off.

I-46015

The following diagram represents the injection-timing point curve of a fuel-injection pump with hydraulic KSB, depending on engine speed, for a warm and for a cold engine.



The broken line occurs with a cold engine and with hydraulic KSB as a result of the higher pressure on the timing-device pistons.
A safety circuit in the pressure regulator prevents the engine from working with too advanced an ignition timing point, even at higher speeds (more noise develops and over a longer period the engine will be thermally overloaded).
The safety circuit in the pressure regulator (6) consists of a ring groove (6.2) on the outer diameter and is connected to the center bore with cross holes. There are cross holes (6.3) above the ring groove in the pressure regulator (6). After a certain stroke of the piston (corresponding to a certain speed) the piston with the ring groove opens the area above the piston.
This causes the pressure to fall and, below this speed, results in a curve similar to that with warm engine.

New Product

40...46,58

DISTRIBUTOR-TYPE FUEL-INJECTION PUMP FOR DIRECT-INJECTION ENGINE IN FORD "YORK"

VDT-I-460/7 En

11.1985

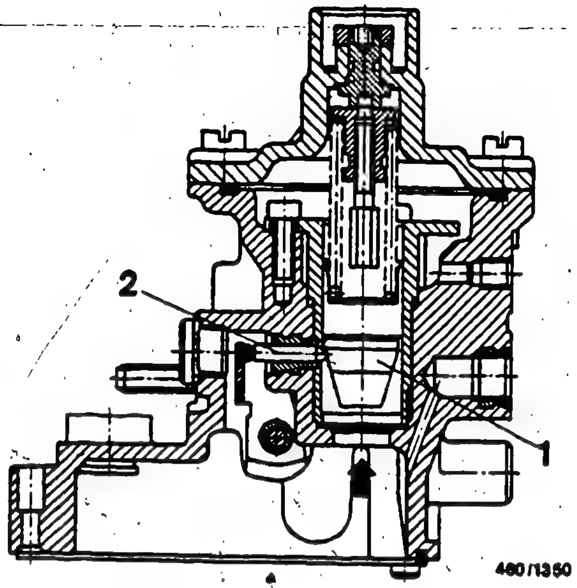
1. General

To obtain optimum torque, power, consumption, exhaust emissions and minimum generation of smoke, a distributor-type fuel-injection pump with

- hydraulically actuated torque control
- 2-spring timing device with return-flow restriction
- hydraulic cold-start accelerator

is being installed for the first time on a direct-injection engine.

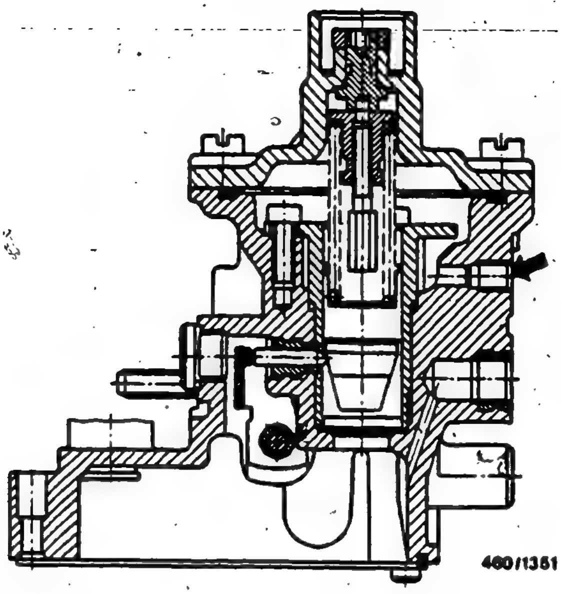
G12 GM



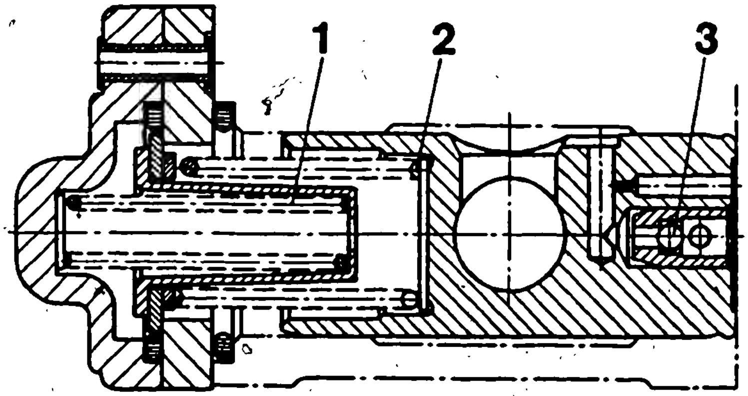
1 = Piston   2 = Adjusting pin

2. Functional description of hydraulically actuated torque control

The pump interior pressure, which rises linearly as a function of engine speed, is applied to a spring-loaded piston (see picture, arrow). As in the case of the manifold-pressure compensator, the reaction of the piston is converted by a cone into a sliding motion, i.e. as the piston moves, the adjusting pin slides over the cone. Consequently, the full-load characteristic is corrected from falling to slightly rising (negative full-load torque control).



When cold-starting, the pump interior pressure rises, controlled by the hydraulic cold-start accelerator. To compensate for the increased pressure, pressure is directed via a connecting line from the cold-start accelerator to the spring side of the hydraulically-actuated torque-control piston (see picture, arrow). This prevents a reaction of the torque-control piston during the cold-start phase, thus preventing undesired generation of smoke due to too high an injected fuel quantity.

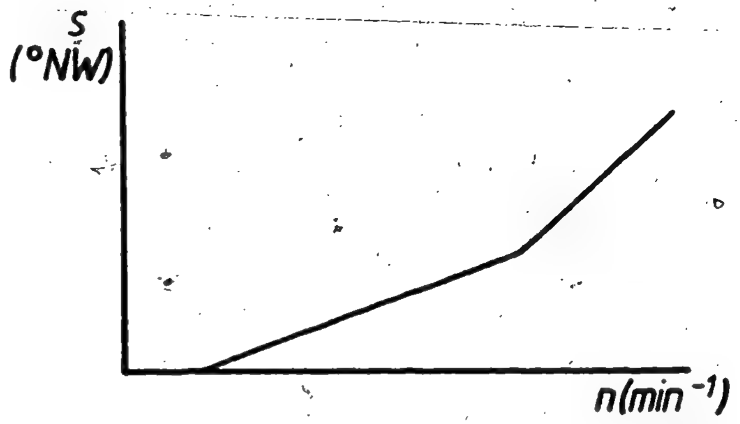


1 = Timing-device cover with preloaded spring
2 = Timing-device spring
3 = Non-return valve

3. Timing device with 2-spring design and non-return valve

Construction:
The version of timing device consists of timing-device cover with preloaded spring, spring in timing-device piston and a non-return valve.

I-46017
Seite 3



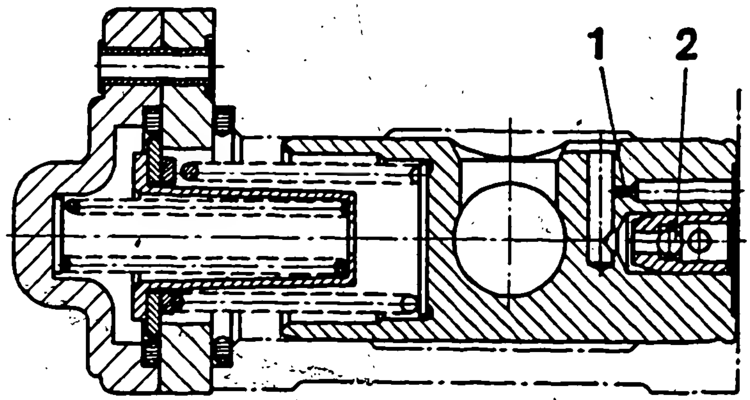
460/1353

s = Timing-device travel
n = Engine speed

3.1 Functional description of 2-spring system

The timing-device springs are connected in series as regards their effect. The spring in the timing-device cover has a higher preload.
According to the low preload of the spring in the timing-device piston, the piston moves only against this spring up to a certain engine speed.
As of this engine speed (kink in curve), the force of the spring in the timing-device piston reaches the preload force of the spring in the timing-device cover, and both springs work together.

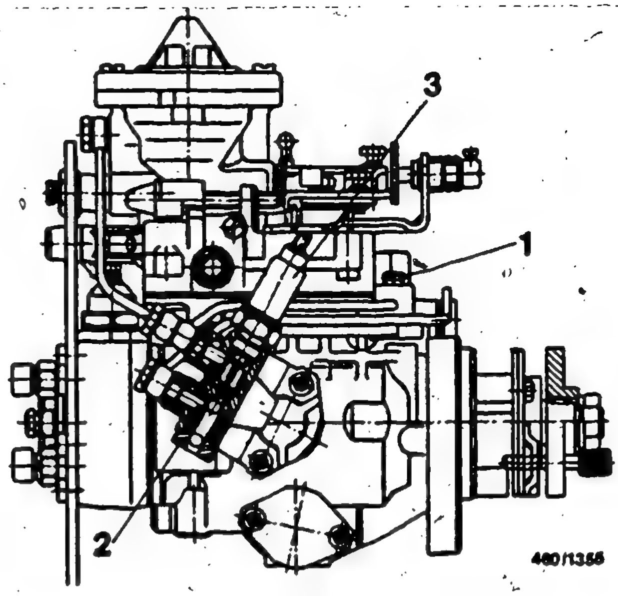
Since these springs act in series, the result is a lower constant spring rate than the spring rate of the spring in the timing-device piston.
This working-together of both springs results in a steeper timing-device characteristic and thus in improved adaptation of the injection timing to the engine at higher engine speeds.



1 = Restriction
2 = Non-return valve

3.2 Operation of non-return valve with restriction

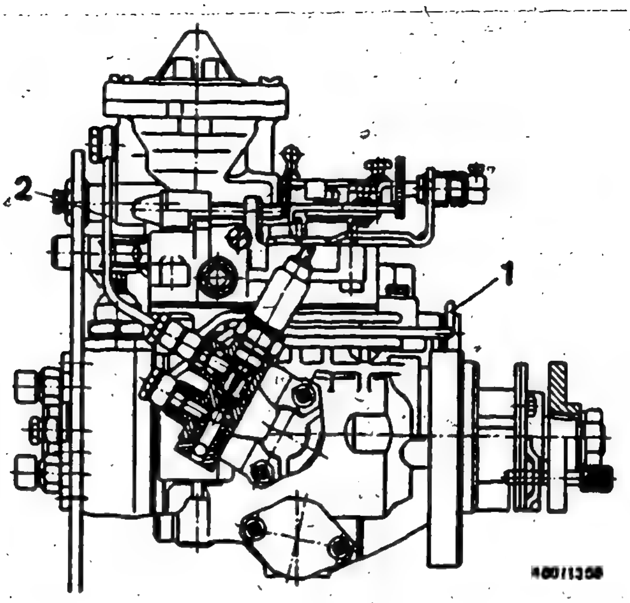
Since the restoring moments (vibrations) are very high with this fuel-injection pump, the timing-device piston has had to be provided with a small restriction. The additional installation of a non-return valve in the timing-device piston results in fast adjustment of the piston.
This valve opens when the piston is moving and closes during injection.



1 = Pressure-control valve
2 = Pressure-holding valve (ball valve)
3 = Expansion element

4. Construction of hydraulic cold-start accelerator

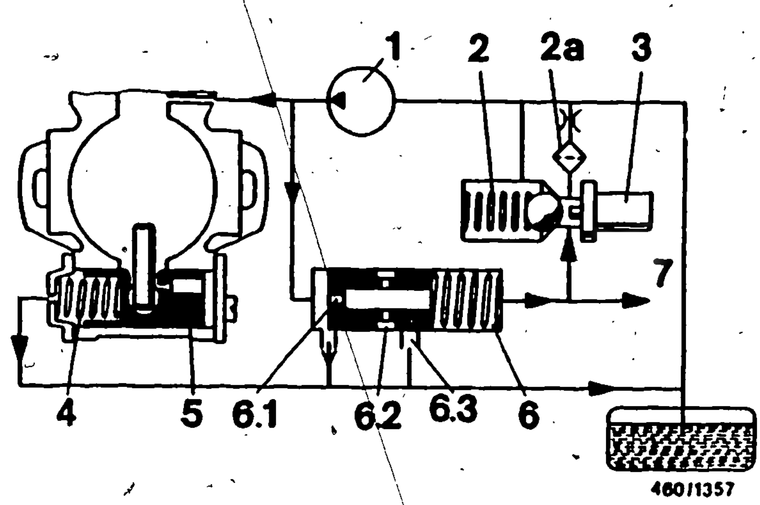
The hydraulic cold-start accelerator consists of a pressure-control valve, pressure-holding valve (ball valve) and an electrically heated expansion element.



1 = Inlet connection
2 = Line to spring side of hydraulically actuated torque control

4.1 Design

Contrary to the normal design of the hydraulic cold-start accelerator which is mounted on the timing device, this cold-start accelerator is on the side of the pump housing and has two additional connecting lines.
One line leads to the inlet connection of the pump; and the other leads to the spring side of the hydraulically actuated torque control. The pump interior pressure is compensated for via this line when cold-starting (hydraulic cold-start accelerator is effective)(smoke-free combustion).

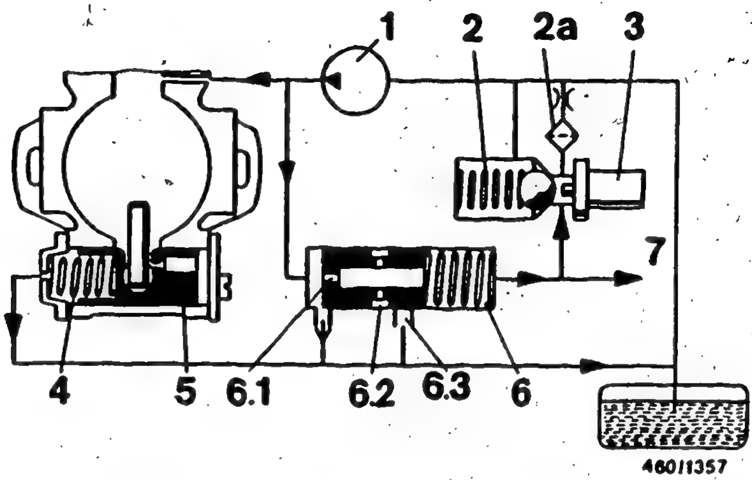


1 = Supply pump
2 = Pressure-holding valve (ball valve)
2a= Restriction
3 = Expansion element
4 = Timing-device spring
5 = Timing-device piston
6 = Pressure-control valve
6.1 = Restriction bore
6.2 = Annular groove
6.3 = Transverse bore
7 = Line to torque control

4.2 Functional description of hydraulic cold-start accelerator

Controlled by the pressure-control valve, the supply pump generates an engine-speed-dependent pressure. This pressure forces the timing-device piston against the timing-device spring, thus adjusting the start of injection as a function of engine speed.
For cold-starting, the injection timing is to be advanced. This advance is achieved as follows.
A partial quantity flows off through the restriction bore in the pressure-control valve.

G21



1 = Supply pump	5 = Timing-device piston
2 = Pressure-holding valve (ball valve)	6 = Pressure-control valve
	6.1 = Restriction bore
2a= Restriction	6.2 = Annular groove
3 = Expansion element	6.3 = Transverse bore
4 = Timing-device spring	7 = Line to torque control

The pump interior pressure is raised by a downstream pressure-holding valve (ball valve) and restriction, and the desired pressure characteristic is obtained. After the engine has been started, the pressure-holding valve is opened after a certain time by the electrically heated expansion element.
The fuel flows off at zero pressure and the advancing by the timing device is switched off.

NEW PRODUCT

Register 40...46, 58
File Identity VDT-I-460/8 En
05.1986

DISTRIBUTOR-TYPE FUEL-INJECTION PUMP WITH NEW GOVERNOR SYSTEM

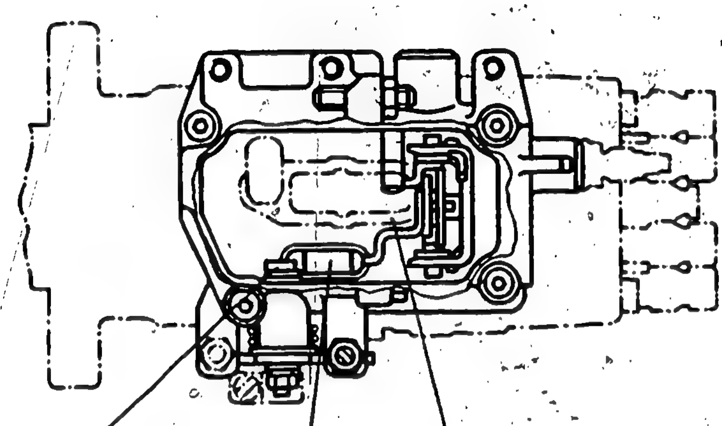
General

To improve the operating conditions during the warm-up phase of the engine (e.g. on VW Golf and Jetta as of 1986 model year), a distributor-type fuel injection pump with

- housing-rigid idle spring (LFG) and

- idle-speed increase, coupled with KSB timing device has been installed.

G23 G23

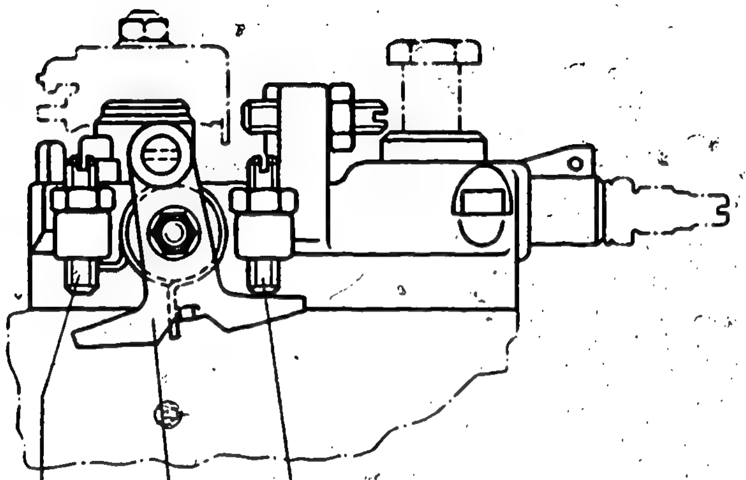


1 = Idle spring
2 = Part-load/maximum-speed governor spring
3 = LFG stop lever

In the new governor system with housing-rigid idle spring, the idle spring is separate from the other governor springs that determine the drive-ability and is flanged onto the LFG stop lever on the side of the pump housing cover.

This means that the idle delivery is adjustable irrespective of the residual delivery.

G24 G24

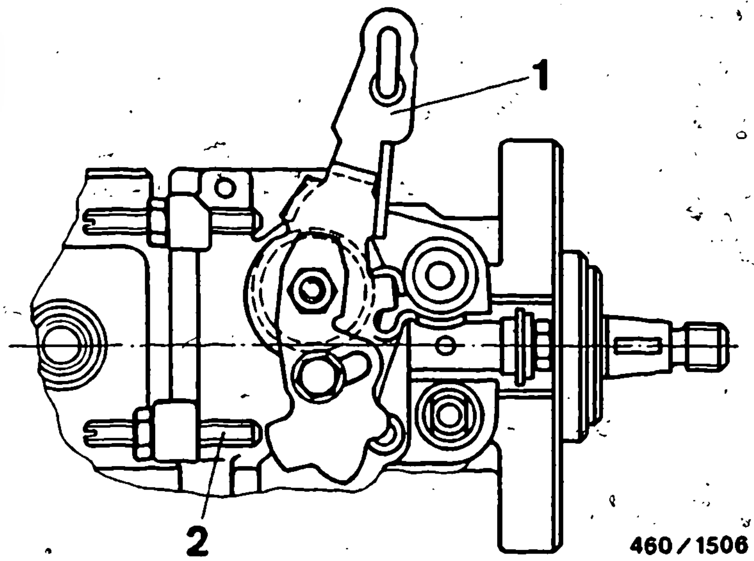


1 = Idle-stop screw
2 = LFG stop lever
3 = Stop screw for increased idle

The idle speed and the injected quantity at idle are adjusted by the LFG stop lever on the side of the pump housing cover.

If the stop lever is up against the stop screw for increased idle, a controlled idle-speed increase is obtained via the separately mounted idle spring.

1-46018
Seite 4



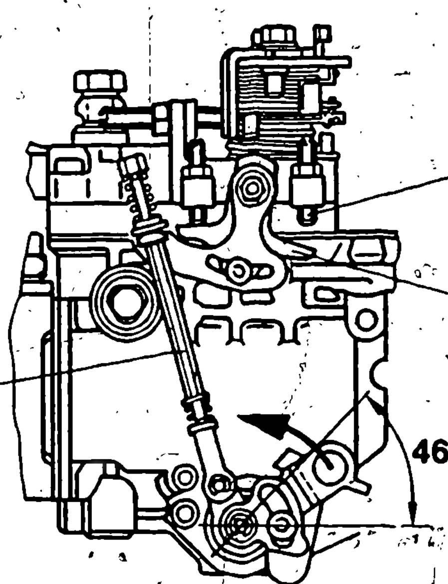
1 = Speed-control lever
2 = Residual-delivery adjusting screw

Irrespective of the position of the LFG stop lever, the desired driving state is selected via the speed-control lever.

Note:

In this version, the previous idle-stop screw is replaced by the residual-delivery adjusting screw, which must not be adjusted.

I-46018
Seite 25

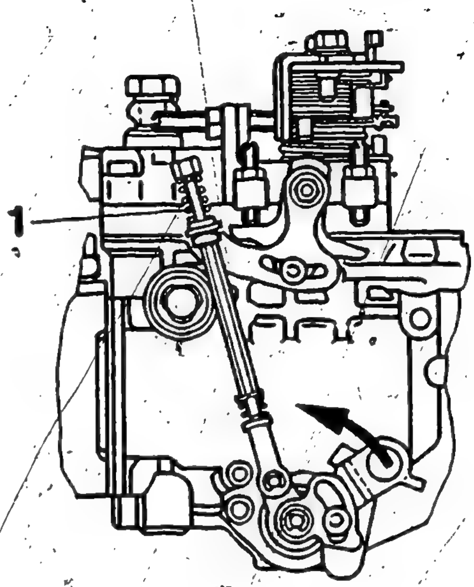


460/1507

1 = Stop screw for increased idle
2 = LFG stop lever
3 = Connecting rod

Functional description of housing-rigid idle spring with idle-speed increase coupled with KSB timing device

When the KSB timing-device lever is actuated up to the pressure point (timing-device stroke starts approximately at 46° position of timing-device lever), the LFG stop lever is brought up against the stop screw for increased idle via the connecting rod.



460/1508

1 = Compression spring

As the KSB timing-device lever is further actuated, the KSB (cold-start accelerator) is activated and the compression spring on the connecting rod is overcome.

This results in idle increase and operation of the timing device.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

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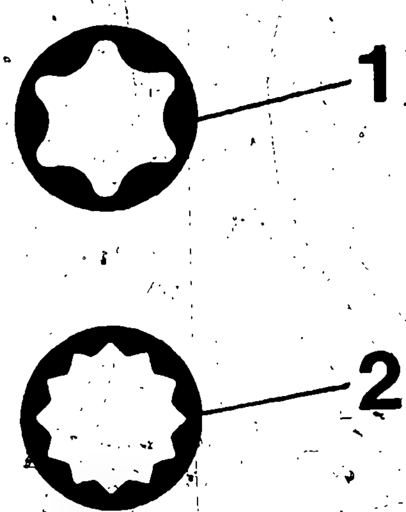
40...46, 58
VDT-I-460/1001 En
11.1984
supersedes edition 7.1981

SCREWDRIVER BITS FOR SCREWS WITH SPECIAL HEADS
Distributor-type fuel-injection pump VE..



1 = Recessed TORX head
2 = Internally serrated head XZN

1. Screws with recessed TORX head (M 5 and M 6)

This type of screw is being introduced step-by-step on all VE pump types. This screw is used for fastening the hydraulic head, housing cover, timing-device cover and manifold-pressure-compensator cover.

Suitable screwdriver bits for torque wrenches (1/2" square) are commercially available.

Designation:

Bit with 1/2" square drive for

Recessed TORX head screws T 30

Hahn & Kolb, Part no. 52 518 - 030
Hazet, Part no. 992-T30
Wera-Kraft, Part no. 767 C-TX 30

Recessed TORX head screws T 27

Hahn & Kolb, Part no. 52 518 - 027
Hazet, Part no. 992 - T27
Wera-Kraft, Part No. 767 C-TX 27

2.Screws with internally serrated head XZN (M 6)

This type of screw is used on some types of VE distributor pumps (e.g. for IHC engines) for fastening the timing-device cover. Suitable screwdriver bits for 1/2" square are likewise commercially available.

Designation:

Bit with 1/2" square drive for

Internally serrated head screws M 6

Hahn & Kolb, Part no. 52 516-060
Hazet, Part no. 990-6
Wera-Kraft, Part no. 760 C-M 6/52

I-460/1004

Obtainable, for example, from: Hahn & Kolb
Postfach 333
7000 Stuttgart 1

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H3

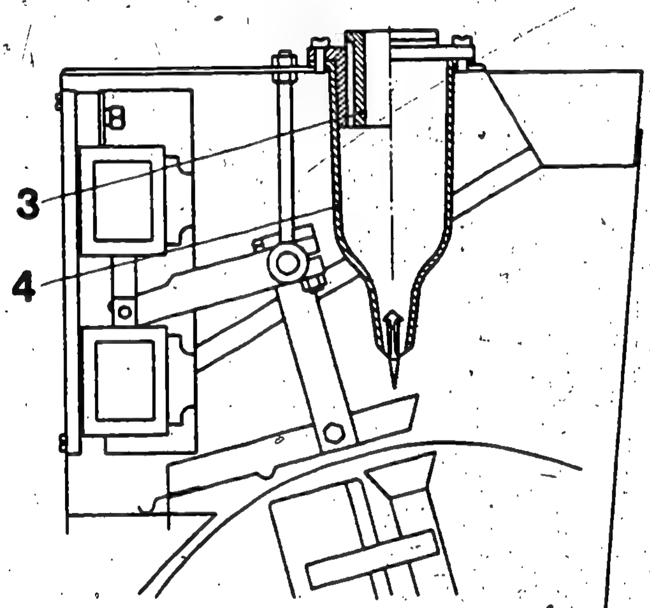
H3

40...46, 58

VDT-I-460/1004 En

4.1985

MOUNTING PLATFORM FOR
CALIBRATING NOZZLE-HOLDER ASSEMBLY
KDEP 1140



While testing with KDEP 1140 on test benches of series EFEP 375...410 and 5.., i.e. on green and blue test benches, it may happen that calibrating oil escapes through the sight glass (Item 4).

Remedy

Use of reduction sleeves of the latest type (Item 3), with longitudinal grooves on the inside.
Part No. 1 680 323 003.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

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H5

After-sales Service
Technical Bulletin

OMISSION OF SUPPLY PUMP PRESSURE TEST
on distributor-type fuel-injection pumps VE..F..

VDT-I-460/125 En
4.1982

The supply pump pressure is of secondary importance when assessing the operation of a VE..F.. distributor-type fuel-injection pump. The fuel delivery and the timing-device travel are the decisive factors and must lie within the specified tolerance.
The checking values (values in parentheses) contained in all existing test-specification sheets under test section 2.2 for the supply pump pressure are thus no longer valid.

The checking of the supply pump pressure is, therefore, to be discontinued with immediate effect when performing the as-received inspection (warranty assessment) on defective injection pumps.

In the case of warranty inspections in the after-sales service, all check measurements given in the test specification sheet and test instruction manual are to be performed, with the exception of the above-mentioned supply pump pressure checking value, in order to locate the decisive operational defect which led to the complaint.
Only this defect should then be stated in the warranty report.

In case of inquiries, please contact your local representative.

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H6

H6

EXPLANATORY NOTES ON DEFECT NUMBER LIST FOR DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS

Complete and correct warranty reports are essential for the quick handling of warranty cases and are the basis for statistical quality control.

For pertinent reasons we should like to make the following explanatory remarks on the defect number list for distributor-type fuel-injection pumps, VDT-WAA 050/9-15, of the warranty manual:

1. Defect numbers

Injection pumps coming to the BOSCH after-sales-service workshops are in principle field goods, i.e. not 0-km items (warranty category 0).

Complaints on field goods should be reported exclusively with the defect numbers printed "straight" and not with those printed in italics (slanting).

2. Defect number 00

The defect number 00 was introduced for the statistical recording and accounting of defects which it was possible to remedy through minor corrections to the distributor-type fuel-injection pump.

Important note:

The checking of an injection pump is governed in general by the checking tolerances in the test-specification sheet (values in brackets). If the actual values are within the checking tolerance and the injection pump does not have any other defects, the warranty claim must be rejected.

For the correct assessment of an injection pump it is necessary that all checking points be measured. If there are several defects, only that defect causing the complaint should be reported.

In the following we describe when to use the defect number 00 when assessing the defects of a distributor-type pump on the injection-pump test bench.

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H7

The defect number 00 should be reported when the actual value is within a checking tolerance (value in brackets) which has been additionally extended by 50 %.

In this case it is not necessary to make a claim in plain text.

Examples of extended checking tolerances:

Full-load delivery:

Checking value (value in brackets)	=	22.3 - 26.7 cm^3/1000 lifts
Checking tolerance	=	4.4 cm^3/1000 lifts
Tolerance extended by 50 % (4.4 x 1.5)	=	6.6 cm^3/1000 lifts
yields an extended checking value	=	21.2 - 27.8 cm^3/1000 lifts

Timing-device travel:

Checking value (value in brackets)	=	2.95 - 4.35 mm
Checking tolerance	=	1.4 mm
Tolerance extended by 50 % (1.4 x 1.5)	=	2.1 mm
yields an extended checking value	=	2.6 - 4.7 mm

If an actual value is outside the extended checking values, look for the cause of the trouble. If no component defect is found, report defect no. 10 in the case of fuel deliveries, and defect nos. 72 and 73 in the case of timing-device travel as well as the actual value in plain text.

Incorrectly set idle deliveries (low idle) must be critically assessed since the idle-adjusting screw is not lead-sealed at the factory. Incorrectly set idle deliveries must only be reported if the lead seal fitted by the vehicle manufacturer is undamaged.

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I-460/126
Seite 5

BOSCH

WARRANTY MANUAL
VDT-WAA 052/9-15 En
Ed. 4

Defect number list
046..

046.. Distributor-type Fuel-Injection Pumps

Troubles with the product as a whole

00 Pump not defective, including slight adjustments
01 Operational trouble, fault not located (make claim in plain text)
02 Damage in transit (make claim in plain text)
11• Full-load delivery wrong (lead seal not damaged)
12• Idle load wrong (lead seal not damaged)
13• Speed regulation wrong (lead seal not damaged)
14 Change from excess-fuel delivery to full-load not correct
15 Excess-fuel delivery insufficient
16 Foreign matter in pump
17• Overall delivered-quantity scatter is excessive
18• Wrong parts (make claim in plain text)
19• Wrong nameplate
10 Fault located, no special defect number (make claim in plain text)

Hydraulic head troubles

21 Main plunger seized in hydraulic head
22 Main plunger seized in regulating collar (VE only)
23 Delivery valve leaky or sticking
24 Ball valve leaky (VA only)
25 Regulator collar sticking
26 Delivery-valve holder leaky
27 Central screw plug leaky
28 Automatic excess-fuel device defective (VA only)
29• Plunger lift to port closing wrong
20 Fault located, no special defect number (make claim in plain text)

Pump housing troubles

31• Missing parts (make claim in plain text)
32• Control lever travel wrong (∢)
33 Plain bearing worn out, tilting play of drive shaft too large
34• Port closing setting wrong
35 Control lever bearing leaky
36• Lead sealing on governor cover is damaged
37 Pump housing leaky
38• Radial-lip-type oil seal leaks
39• Slotted shoulder screw leaks
30 Fault located, no special defect number (make claim in plain text)

046.. (Continued)

Mechanical governor troubles (VE only)

41 Sliding sleeve sticking
42 Dimension "MS" incorrect
43 Starting lever sticking
44 Flyweights sticking
45 Ball pins loose
46 Shut-off shaft leaky
47 Governor shaft leaky
48• Stop lever difficult to move
49 Load-dependent start of pump delivery incorrect
40 Fault located, no special defect number (make claim in plain text)

General leaks

51 Timing advance cover leaky
52 Adjusting hole leaky
53 Governor cover leaky (VE only)
54 Pressure-regulating valve leaky
55 O-ring at hydraulic head defective (leaky)
56 Bleeder screw leaky
50 Fault located, no special defect number (make claim in plain text)

Drive troubles

61 Plunger return spring broken
62 Driving pin in came plate loose
63 Rubber buffer worn
64 Cam roller ring sticking
65 Drive shaft seized
68 Rollers and cams seized
60 Fault located, no special defect number (make claim in plain text)

Timing device troubles

72 Timing-device travel too large
73 Timing-device travel too small
74 Timing-device piston sticking
75• Wrong timing-device spring
76• Wrong timing-device piston
70 Fault located, no special defect number (make claim in plain text)

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Seite 4

BOSCH

WARRANTY MANUAL
VDT-WAA 052/9-15/1 En
Ed. 4

Defect number list
046..

046.. Distributor-type Fuel-injection Pumps

Supply pump troubles

81 Overflow valve sticking (VA only)
82 Pressure regulating valve sticking
*83** *Wrong supply pump pressure*
84 Vane sticking in supply pumpe
85 Supply pump seized
*86** *Wrong overflow quantity*
80 Fault located, no special defect number (make claim in plain text)

Auxiliary device troubles

91 Manifold-pressure compensator/altitude-pressure compensator defective or leaky
92 Electric shutoff (ELAB) defective or leaky
94 Cold-start accelerator defective or leaky (VE only)
95 Temperature-dependent start quantity incorrect
96 Idle increase incorrect
90 Fault located, no special defect number (make claim in plain text)

* Only use the numbers in *italics* for warranty cases on 0-km items (warranty types 5, 6 or 8).

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TEMPERATURE INDICATOR

for determining the calibrating oil temperature at the injection-pump overflow of VE..-distributor pumps

0 460 4..

The increasingly stringent requirements placed upon the adjustment and testing of VE pumps necessitates, among other things, the precise compliance with a specified calibration-oil temperature.
Up till now, the temperature of calibration oil entering the pump was measured and had to be maintained by the mechanic at 40 + 5 °C. The new Test Specs issued upon the conversion to the ISO calibration oil specify a temperature at the overflow of 45 ± 3 °C.

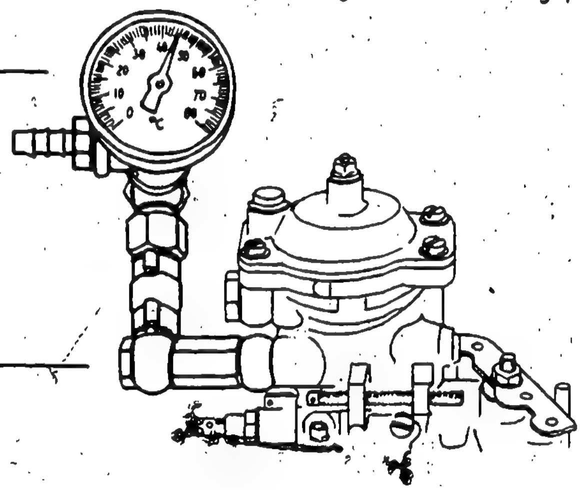
For this reason, when a VE pump is tested a temperature indicator must be connected in at the VE-pump overflow in order that the calibration-oil temperature actually present in the distributor pump can be measured and kept constant by means of appropriate measures.

Temperature indicator Part Number 1 687 230 029 comprising the following parts:

Bimetal thermometer

Overflow line

Inflow line



The overflow temperature of the calibration oil is dependent upon the pump speed, e.g. the temperature drops when the pump speed is low and it rises at higher pump speeds. This means that before every delivery measurement the calibration oil and pump, if necessary, have to be warmed-up or cooled-down. The temperature in the tank, though, during this process must be maintained at 35 °C.

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In order to maintain the overflow temperature at 45 ± 3 °C during measurement and testing, it is necessary that the order of the Test Steps in Section 1 "Setting Values" of the Test Specifications Sheet is changed as shown below (the points concerned are underlined). The Test Step sequence in Section 2.3 remains unchanged.

1. Setting values	Speed min^{-1}	Setting values	Charge-air pressure (bar)	Delivery scatter cm^3
1.1 Timing-device travel		mm		
1.2 Delivery-pump pressure		bar (kgf/cm^2)		
1.3 Full-load delivery <u>with</u> charge-air pressure		cm^3/1000 strokes		
Full-load delivery <u>without</u> charge-air pressure		cm^3/1000 strokes		
1.4 Idle regulation		cm^3/1000 strokes		
<u>1.5 Maximum-speed regulation</u>		cm^3/1000 strokes		
<u>1.6 Start</u>		cm^3/1000 strokes		
1.7 Load-dependent port closing		-		

<u>Test sequence</u>

<u>Section "1. Setting values"</u>

1. Drive the pump at the upper rated speed until the overflow temperature has reached approx. 46 °C. Open or close the throttle (fitted in the injection-pump test bench) in order at the same time to control the inlet temperature.

2. While measurement is being carried out, the tank temperature is to remain at approx. 35 °C.

3. Set the pump in accordance with Section "1. Setting values".

4. If the overflow temperature (45 ± 3 °C) is exceeded or dropped below during the delivery measurement, the pump and calibration oil must cooled down by running briefly at the lower rated speed or they must be warmed up by running at the upper rated speed. While this takes place delivery measurement is to be stopped.

<u>Section "2.3 Delivery quantities"</u>

If necessary, before starting the delivery-quantity measurements, warm up the calibrating oil to the lower limit of the overflow temperature by running the pump at upper rated speed. The temperature of the overflow calibration oil can be maintained at the specified 45 ± 3 °C by complying with the test-step sequence as given above.

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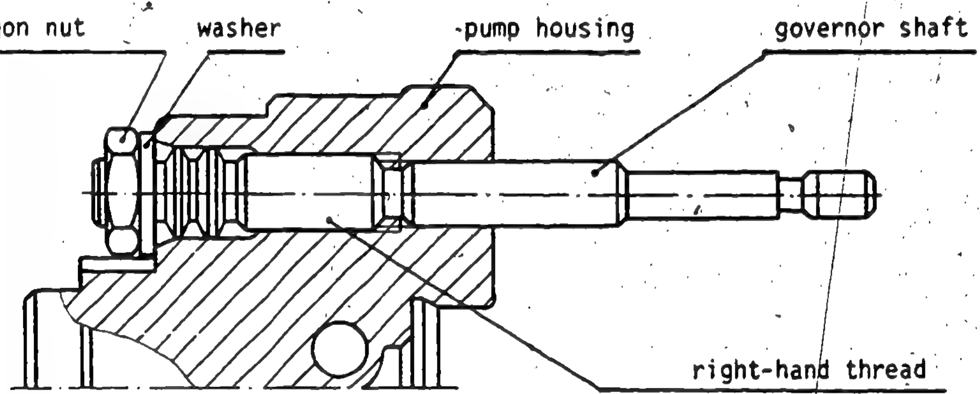
CHANGING THE THREAD ON THE GOVERNOR SHAFT — 40-46, 58

Distributor-type fuel-injection pumps VE .. F .., 0 460 .. — VDT-I-460/130 En

with register diameter 50 mm — 4.1983

As from FD 151 the thread of the governor shaft and the pump housing on all clockwise rotating distributor-type fuel-injection pumps with register diameter 50 mm was changed from a left-hand to a right-hand thread.

The slotted nut used up till now on distributor-type fuel-injection pumps is replaced by the hexagon nut 1 463 300 304 and washer 2 916 012 017.



The part number of the pump housing and of the governor shaft are to be found in the latest service-parts list.

40...46, 58
VDT-I-460/131 En
9.1983

PLUNGER AND CONTROL-COLLAR SEIZURE
ON VE-DISTRIBUTOR PUMPS
CAUSED BY FUEL DEPOSITS

Occasion has arisen for us to provide you with the following information regarding the handling of defective VE distributor pumps (this applies particularly to Warranty Claims).

Deposits resulting from dirty or contaminated fuel can lead to a reduction in clearances and cause plunger and control-collar seize-up.

On the defective pumps, the deposits on the drive shaft, on the cam-plate track, as well as on the control collar and plunger could be clearly seen with the naked eye. There were also deposits on the respective bores. The deposits concerned form a hard grey-brown coating which cannot be wiped off and which mainly forms on bright steel surfaces.

Analysis of the coating showed that the deposits were composed of inorganic sulphates. These originate from fuels which have been contaminated with sulphuric acid.

Furthermore, it cannot be completely ruled out that the fuel had been mixed with waste engine oil and contaminated in this manner.

Due to the fact that we have no influence on clean fuel being used, we must point out that Warranty Claims cannot be accepted for defects which are caused by fuel deposits.

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FAILURE OF THE FUEL-INJECTION SYSTEM DUE TO WATER IN THE FUEL

VDT-I-460/133-En
10.1983

Information sent us from the After-Sales Service Organisation on the failure of distributor-type fuel-injection pumps because of rust, has led us to point out the following:

Rust damage to distributor-type fuel-injection pumps is not a material or manufacturing fault which is covered within the framework of our guarantee conditions. Failures of this kind are due entirely to an inadmissibly high water content in the fuel system, upon which we, as manufacturers of diesel fuel-injection equipment, have no influence.

Failure of the fuel-injection system due to water damage can be avoided by draining off the water befor it is too late. We therefore recommend fitting a water-level indicator for diesel box-type filters (part no. 1 457 001 001), which by means of a control lamp informs the driver in good time that he should drain off the water that has gathered in the system (See also KH Information of 9.11.1982).

If there is a very high water content in the fuel, we recommend water separator 0 450 198 008 (design with flat flange on the cover, specially for VAG vehicles) which can be used for all diesel engines, as well as water separator 0 450 198 009 (design with angled flange on the cover and with connecting parts). Further details can be found in the KH Information Bulletins of 7.8.1980 and 7.11.1980.

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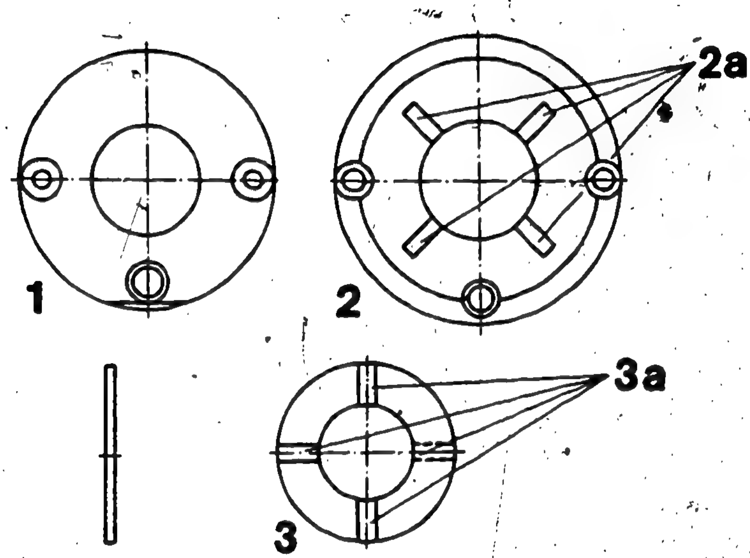
40...46, 58
VDT-I-460/137 En
9.1984

MODIFICATION TO THE SLOTTED DISK AND THE SUPPORT RING ON VE DISTRIBUTOR FUEL-INJECTION PUMPS



1 = Support ring, old version
2 = Support ring, new version
2a = Slots (new)
3 = Slotted disk, old version
3a = Slots (omitted)

The slotted disk (position 17) and the support ring (position 9) on the VE distributor fuel injection pumps have been modified such that in future the slots are no longer in the slotted disk but have been transferred to the support ring (see figure).

During customer service, when assembling slotted disks and support rings, the following points must be taken into account:

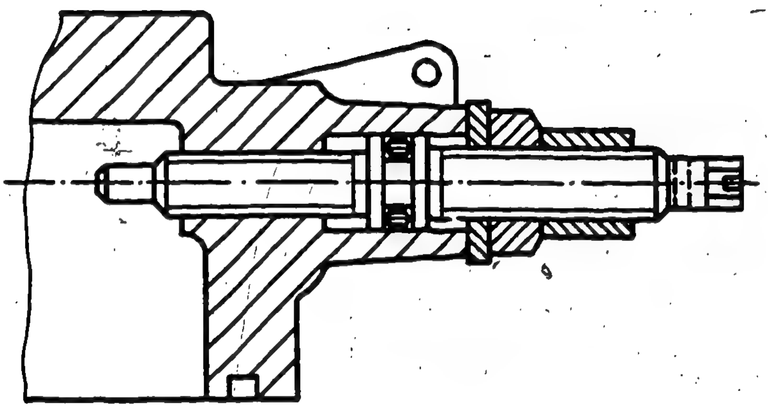
It is permissible to assemble a slotted support ring (new version) together with an old version disk with slots. On the other hand, it is not permissible to assemble an old version support ring without slots together with a new version disk without slots.

The service parts lists for the VE distributor injection pumps concerned will be amended accordingly.

Please direct questions and comments concerning the contents to our authorized representative in your country.

40...46,58
VDT-I-460/141 En
9.1985

MODIFICATION TO HOUSING COVER
DISTRIBUTOR-TYPE FUEL-INJECTION PUMP
VE..F.. 0 460 4..



On all distributor-type fuel-injection pumps VE..F.. the female thread of the threaded pin in the housing cover is being changed from M 6 x 1 to M 8 x 1.

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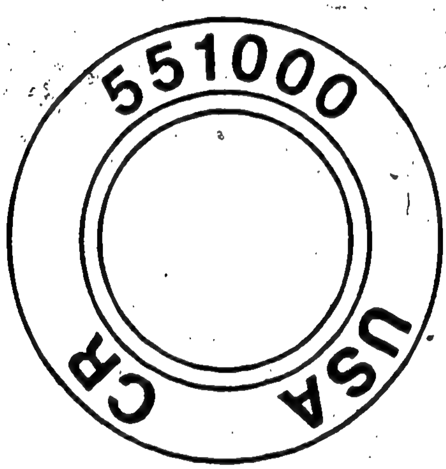
Since the previous housing covers with female thread M 6 x 1 can be replaced by the new housing covers with female thread M 8 x 1 without influencing the operation of the distributor-type fuel-injection pump, the housing covers of the previous version will become invalid for service parts after being used up. When ordering the new version of housing cover, remember that a threaded pin M 8 x 1 is required for setting the full-load delivery. The threaded pin with thread M 6 x 1 will remain valid for service parts.

As of May 1985 the modification will be introduced gradually on all VE..F.. injection pumps. The part no. of the housing covers and threaded pins should be taken from the latest service-parts lists.

Please direct questions and comments concerning the contents to our authorized representative in your country.

RADIAL-LIP-TYPE OIL SEAL
1 460 283 301 FOR DISTRIBUTOR-TYPE
PUMPS



In particular cases, despite allowable tilting play, there may be leaks at the drive shafts of distributor-type pumps. This is caused by cracks in the circumferential direction of the radial-lip-type oil seal 1 460 283 301 with delivery designation "CR 551 000 USA". The delivery designation is marked on the end face of the metal jacket (see picture).

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H20

H20

If a distributor-type pump is brought in with leaks at the drive shaft, proceed as follows:

- Measure tilting play of drive shaft.
- If the tilting play is within the specified tolerance (max. 0.25 mm in both directions), replace the radial-lip-type oil seal. Replacement can be performed with service tool KDEP 1113 without dismantling the pump.

Replacement of the radial-lip-type oil seal is to be performed free of charge during the warranty period. After expiration of the warranty period, a goodwill application may be made.

Since radial-lip-type oil seals with delivery designation "CR 551 000 USA" may no longer be installed, please check your inventory of these oil seals. Any existing inventories should be sent in to KH/QSG. They will be replaced immediately free of charge.

Repairs and returns from any existing inventories should be reported through the usual channels with reference to this Technical Bulletin.

Procedure:

Federal Republic of Germany:

With warranty and goodwill application - Germany G21 and delivery slip KH/VKD3-15 333 to

Robert Bosch GmbH
KH/QSG
Auf der Breit 4
7500 Karlsruhe 41

Other countries:

Through RG/AV with warranty and goodwill application - outside Germany G21 and delivery slip to

Robert Bosch GmbH
KH/LAV2-Auspackraum
zur Weiterleitung an KH/QSG
Auf der Breit 4
D-7500 Karlsruhe 41

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Division KH
Technical After-Sales Service (KH/VKD2)

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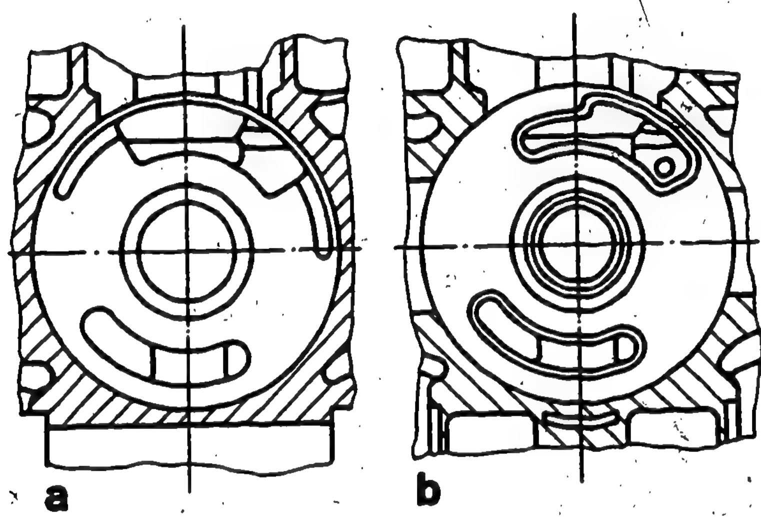
PUMP-HOUSING MODIFICATION ON DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS FOR IHC



a = Previous version   b = New version

On distributor-type injection pumps VE...F.. for IHC, the shape of the fuel inlet in the pump housing (Niere) has been modified as of FD 448 (see picture).

This modification also calls for a modification to the supply pump and the support ring.

If, when repairing, a pump housing of the new version is used, it is necessary also to use the support ring (Item 9) and the supply-pump service-parts group (Item 801 or 7) according to the latest service-parts list.
Use of the previous versions of support ring and supply pump will result in no pump interior pressure building up.

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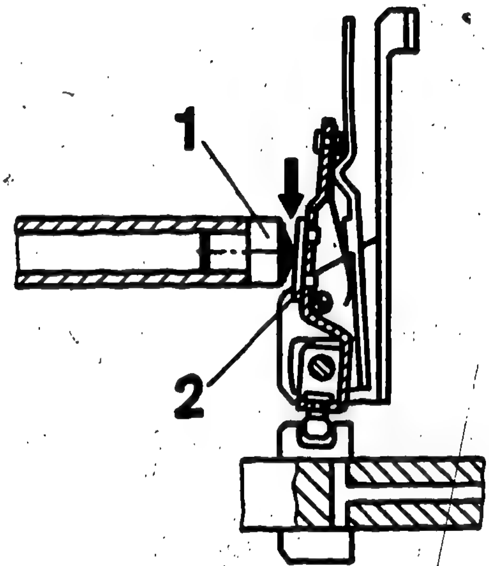
UPRATED STARTING LEVER AND PLUG
IN VE..F.. PUMPS



1 = Plug
2 = Riveted-on plate
To prevent wear at the contact point between plug (governor sleeve) and starting lever, a harder material (DMO 5) is being used.
This prevents the plug working into the starting lever.

Starting levers and plugs made of material DMO 5 can be identified by the following features:
- Sleeve plug with grooves (see picture, arrow)
- Starting lever with riveted-on plate

If repairing, under no circumstances install a hard plug made of DMO 5 material with a soft starting lever (without riveted-on plate) or vice versa.

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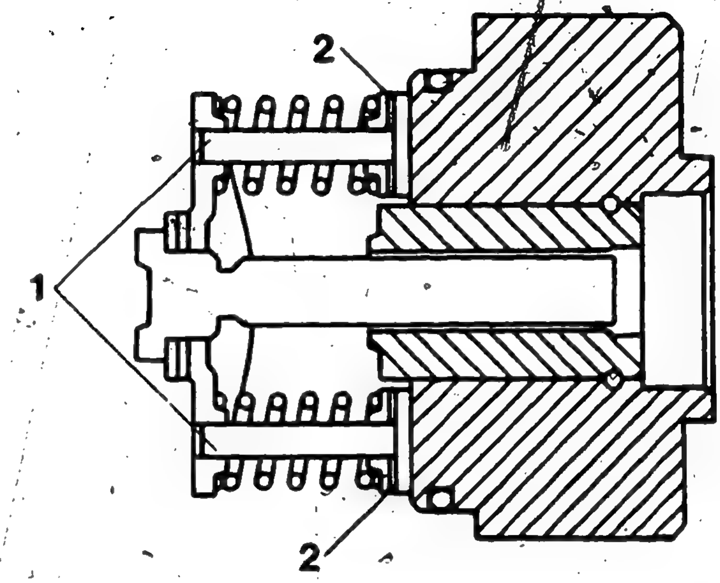
VE PUMP

Assembling the distributor head

11.1986

In the case of distributor-type fuel-injection pumps installed in vehicles with direct-injection engines, the plunger return spring assembly is positioned in series production at the TDC of the distributor plunger with a specific force.

These pump versions are, therefore, recognizable in that the designation K_{OT} is used in the relevant test-specification sheet instead of the K_F adjustment dimension.



1 = Plunger return spring assembly
2 = Shim rings

The adjustment method with K_F dimension cannot be applied with these pump versions.

When repairing, make absolutely certain that the shim rings removed from beneath the spring seat when disassembling are reinstalled in the same quantity and with the same thickness.

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H28

VE FUEL INJECTION PUMP 0 460 494 071, ..114 VDT-I-460/138 En
IN OPEL KADETT/ASCONA-DIESEL 9.1984
Load-dependent injection timing (LFB)
no longer fitted

As from FD 349 (September 83), the load-dependent injection timing (LFB) is no longer fitted to the VE distributor fuel-injection pumps
0 460 494 071 (VE 4/9 F 2300 R 82),
0 460 494 114 (VE 4/9 F 2300 R 82-1)

VE distributor injection pumps which are fitted with load-dependent injection timing can be recognized due to the following features:

- Hole bored through the governor shaft and the collar.
- A second ball is fitted in the pump housing at both the governor shaft in addition to the ball fitted on the side of the pump at the fuel inlet.
- Rotational speed specifications for the adjustment of load dependent injection timing are included in the test spec sheets (point 1.7).

The features are not present with VE distributor pumps not fitted with load-dependent injection timing.

Up to and including FD 351 (in November 83), the VE distributor pumps given above will continue to be fitted with a pump housing which has a ball at both the governor shaft, even these pumps are not fitted with load-dependent injection timing as of FD 349.

J1

These pumps are identified by means of a blue paint marking in the vicinity of the ball fitted above the governor shaft.

As of FD 352 (December 83), both the ball and the blue paint marking are omitted.

Those VE distributor pumps on which the load-dependent injection timing is removed during the course of repair, are also to be identified by a blue paint marking in the vicinity of the ball above the governor shaft.

The test specs and the service part lists will be amended accordingly.

Please direct questions and comments concerning the contents to our authorized representative in your country.

40...46, 58
VDT-I 460/139 En
11.1984

DISTRIBUTOR-TYPE FUEL-INJECTION PUMP
0 460 414 014 (VE4/11F1200R94-2)
in Steyer tractor

The Steyer tractor model 8075 with engine WD 411.45/3,45I/47 kW is equipped with the above-mentioned fuel-injection pump.
Some of these VE distributor-type injection pumps have a hydraulic head with delivery valves which do not correspond to the status of the service-parts list.
The part numbers which differ from the service-parts list are as follows:

Designation	Part No.
Hydraulic head (Item 50)	1 468 334 401
Delivery valve (Item 55)	1 468 522 001

The VE distributor-type pumps in question can be recognized by the FD (FD 441) as well as by the letter A on the fastening flange of the pump housing.

When repairing, it is necessary either to change delivery valves and hydraulic head together and to replace them by the service parts given in the service-parts list, or, since the use of the service parts which differ from the service-parts list does not result in any adverse effect on the VE distributor-type pump, to use the above-mentioned service parts which differ from the service-parts list.

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When setting this VE distributor-type injection pump, however, it is then necessary to perform the following settings which differ from the test-specification sheet:

1. Prestroke setting = 0.5 mm
2. Test specifications Sec. 2.3 = 500 min^{-1}; 57.5-60.5 cm^3/1000 lifts (55.6-62.4) cm^3/1000 lifts

All other settings are to be performed in accordance with the data given in the test-specification sheet.

Responsible:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

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J4

DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS WITH LEAKING CONTROL-LEVER BEARING IN MAN COMMERCIAL VEHICLES

In MAN commercial vehicle engines D 0226 MKF/170 with distributor-type fuel-injection pump 0 460 426 028, VE 6/12 F 1400 R 120 with manifold-pressure compensator it is possible in some cases that after a short operating time the bearing bushing on the control-lever shaft will become worn and begin to leak.

In the event of failure during the warranty period the distributor-type injection pump must be converted to the latest version with extended bearing bushing.

Since the conversion also requires MAN parts it is necessary to obtain the complete conversion kit from your nearest MAN agent. Therefore, please contact your agent and ask him to maintain sufficient stocks of the following parts set:

Bosch distributor-type pump	MAN parts set
0 460 426 028	81.11102-6012

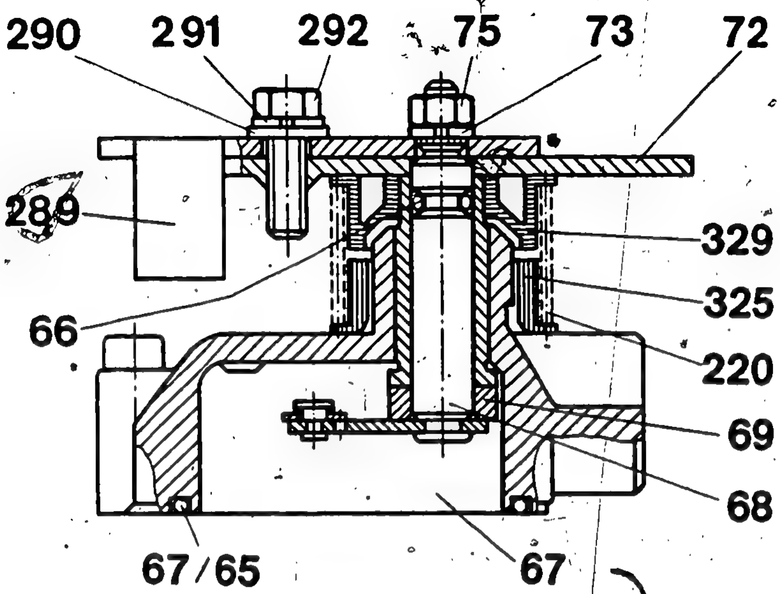
The conversion as well as the costs for setting should be handled with warranty report G21 stating the defect number 35 and referring to this Service Bulletin. For this work we will reimburse you max. 15 work units.

After expiration of the warranty period the conversion is to be carried out subject to payment.

After conversion the MAN customer number on the name-plate of the pump must be changed; there is no change to the Bosch part number.

MAN cust. no. Old	MAN cust. no. New	Bosch part number
-7535	-7516	0 460 426 028

As of FD 441 (Jan. 1984) the modifications are incorporated in series production.



66	= O-ring	220	= Cyl. helical coiled spring
67	= Manifold-pressure compensator	289	= Control lever
67/65	= Seal ring	290	= Plain washer
68	= Control shaft	291	= Spring lock washer
69	= Shim	292	= Micro-encapsulated screw
72	= Control lever	325	= Spring seat (new)
73	= Spring lock washer	329	= Spring seat
75	= Hexagon nut		

New control-lever bearing with extended bearing bushing

Please direct questions and comments concerning the contents to our authorized representative in your country.

DISTRIBUTOR-TYPE INJECTION PUMP 0 460 426 032

VE6/12 F 1400 R 132 FOR MAN COMMERCIAL VEHICLES
12.192 F.. and 14.192 F..

WITH DIRECT-INJECTION ENGINE D 0226 MK

The above-mentioned vehicles with direct-injection engines have a power output of 141 kW (192 HP-DIN). The fuel is injected at a pressure of 200 bar.

This places extremely heavy demands on the distributor-type injection pump and therefore necessitates for the first time the use of extremely strong materials for the drive parts.

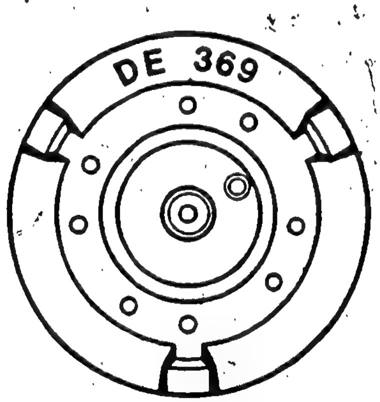
The slotted washer, bearing pin and rollers are made from a special, high-strength steel (DMO 5).

Drive shaft, cam roller ring and cam plate are uprated and have undergone special hardness treatment.

To rule out any confusion with service parts of similar appearance, these parts are identified with "DE" (standing for direct injection) and the last 3 digits of the part number.

In case of repair, use only the parts listed on the microfiche and identified with DE, since otherwise the distributor-type injection pump will fail after a short period in service.

Example:
Cam plate



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Technical After-Sales Service (KH/VKD2)
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40...46, 58

DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VDT-I-460/142 En
0 460 494 138 installed in turbo diesel
VW Golf, Jetta; Audi 80 9.1985
Interchangeable distributor-type fuel-injection pump

The above-mentioned vehicles with distributor-type fuel-injection pump 0 460 494 138 (VE 4/9 F 2250 R 149) as of FD 451 (Nov. 84) have in some cases been equipped with the interchangeable distributor-type pump 0 460 494 134 (VE 4/9 F 2250 R 134-1).
Version .. 134 can be identified by the stop lever and the 2-spring system on the control lever.

The nameplate of pump .. 0 460 494 134 has the nameplate of pump .. 0 460 494 138 bonded over it. These pumps have the serial numbers 00001 to 01800.

The setting of such distributor-type injection pumps on the injection-pump test bench must, therefore, be performed as for pump .. 0 460 494 134.

Likewise, the service-parts list for pump version 0 460 494 134 is valid.

There is no change in the injection timing (0.90 mm ± 0.02 mm stroke ABDC).

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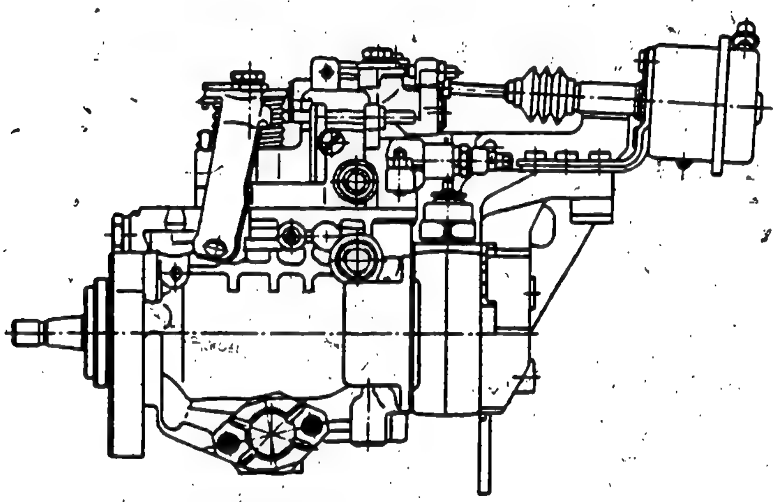
New Product

VDT-I-460/6 En
10.85

DISTRIBUTOR-TYPE FUEL-INJECTION PUMP WITH EXTERNAL MANIFOLD-PRESSURE COMPENSATOR (VE..R.170) installed in VW type II turbo diesel (01.85 →)



Due to the installation position of the engine in the turbo diesel vehicle, it has been necessary to change the overall height of a hitherto known distributor-type fuel-injection pump with manifold-pressure compensator so that the overall height of the engine is the same as that of the previous naturally-aspirated diesel engine. This has been achieved by lateral mounting of the manifold-pressure compensator on the distributor-type pump while retaining the installation position on the engine.

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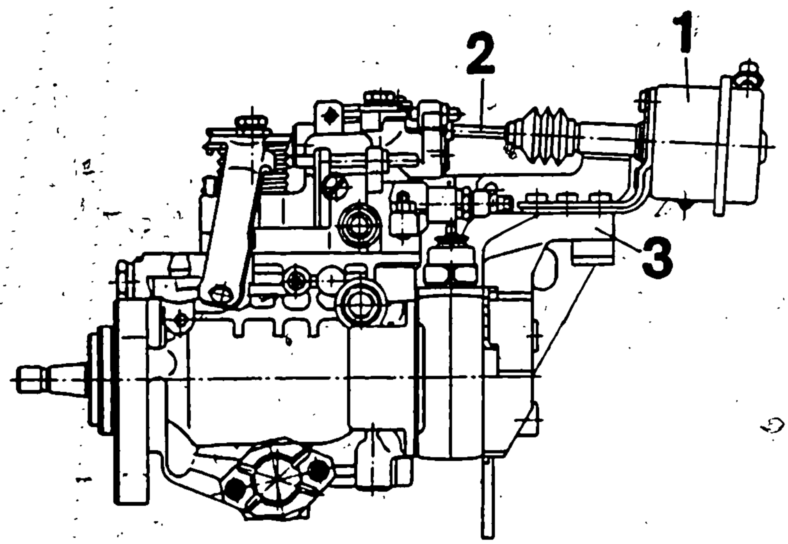
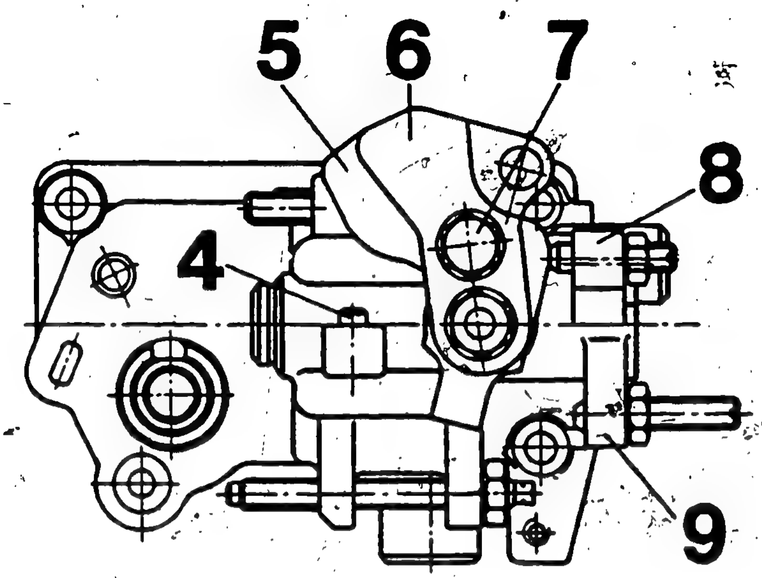


Design of external manifold-pressure compensator

1 = Aneroid capsule
2 = Connecting rod
3 = Support bracket

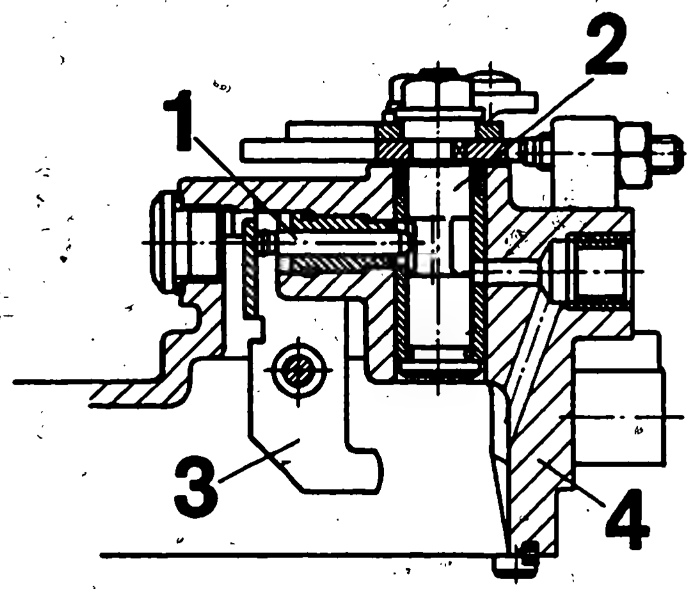


Design of external manifold-pressure compensator (continued)

4 = Full-load charge-air-pressure stop
5 = Manifold-pressure compensator control lever
6 = Manifold-pressure compensator central lever
7 = Hexagon screw
8 = Inducted-quantity stop
9 = Intermediate charge-air pressure stop

Note:

Do not loosen hexagon screw of control lever/central lever while distributor-type pump is mounted on engine since, otherwise, it will be necessary to reset the control lever and central lever with respect to each other on the injection-pump test bench.



1 = Guide pin
2 = Sliding bolt
3 = Control lever
4 = Stop housing

Functional description

The manifold-pressure compensator (aneroid capsule) is screwed onto the hydraulic head by means of a support bracket.
By means of a connecting rod, the aneroid capsule is connected to the stop housing and, depending on the charge-air pressure, forces the manifold-pressure-compensator control lever in the direction of the full-load charge-air-pressure stop. This rotary motion is transmitted to the eccentric sliding bolt in the stop housing.
A guide pin that engages the sliding bolt thus acts axially on the control lever, limiting the full-load delivery.

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Parts Cleaning

Gen.

Use of highly-inflammable cleaning agents, or cleaning agents which are dangerous to health

VDT-I-Gen./18 En
7.1978

When cleaning parts which come from vehicle electrical products prior to repair, it is permitted to use the following cleaning agents: Benzine, trichloethylene (tri) and perchloroethylene (per). These are dangerous, and must be handled with appropriate care. The relevant safety regulations in West Germany are:

Regulations concerning work with inflammable liquids (VbF) issued by the Federal Labor Ministry (BmA).

Safety regulations for the use of chlorinated hydrocarbons
as applied to the works ZH1/222
as applied to personnel ZH1/119
as issued by the Federation of the Trade co-operative Associations.
(Central Association for Accident Prevention and Industrial Medicine)
Langartweg 103, D-5300 Bonn 5).

1. Benzine, acetone and ethanol (ethyl alcohol) are inflammable liquids and their mixtures with air are dangerous due to the risk of explosion. Parts washing may only take place in tanks or containers solely intended for this purpose and equipped with a "melt" safety device for the lid which, in case the liquid catches fire, causes the lid to close automatically and smother the fire. In the case of larger containers (exceeding 500 x 500mm) some form of suction,extraction must be provided.

1.1 Generators, alternators, wiper motors, small-power motors and other electrical equipment for installation in vehicles are, in ever increasing numbers, being equipped with capacitors having long storage times (e.g. for interference-suppression purposes in radio-receiver or transmitter installations).

When washing such parts, it is possible that a capacitor discharge can occur when the part is immersed in the cleaning agent. This can lead to an inflammable liquid catching fire. For this reason, parts on which a capacitor is fitted are only to be washed in trichlorethylene (tri) or perchloroethylene (per).

1.2 In the case of starting motors, it has already been pointed out in earlier repair instructions that the parts should be thoroughly dried after washing in benzine, this applies particularly to windings. With sliding-gear starting motors, the first test run after washing out must be performed without the closure cap in order to avoid the possibility of explosion.

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2. Trichlorethylene (tri) and perchloroethylene (per) are both liquids whose vapors have a stupefying effect, and which are dangerous to health if inhaled over long periods. Tri vapor is heavier than air, and therefore especially dangerous at floor level. Gloves and goggles are to be worn when washing out parts in these liquids.

If cleaning of parts is carried out regularly, or continuously, in trichlorethylene only containers or tanks intended solely for this purpose are to be used, and the suction extraction device is to be switched on. When washing parts do not bend over the container.

After-sales Service
Technical Bulletin

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NEW DATE OF MANUFACTURE FROM 1980
for Bosch products

VDT-I-Gen. 027 En
3.1980
Replaces VDT-BMA 032/5 En

Every ten years the figures denoting the month change in the date of manufacture (FD) for Bosch products.

In the years 1980 - 1989 we shall be using the month-figures 41 - 52 for January to December.
Some products are only marked with quarterly figures (e.g. spark plugs and nozzles). Since the third quarter of 1978, the quarterly figure used has been the FD of the second month of the appropriate quarter.

In front of the month-figures in the three-figure FD number, we give the year-figure, so that Bosch products from 1980 onwards will receive the following dates of manufacture (as a reminder we have quoted the FD for 1979):

	(1979)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
January	921	041	141	241	341	441	541	641	741	841	941
February	922	042	142	242	342	442	542	642	742	842	942
March	923	043	143	243	343	443	543	643	743	843	943
April	924	044	144	244	344	444	544	644	744	844	944
May	925	045	145	245	345	445	545	645	745	845	945
June	926	046	146	246	346	446	546	646	746	846	946
July	927	047	147	247	347	447	547	647	747	847	947
August	928	048	148	248	348	448	548	648	748	848	948
September	929	049	149	249	349	449	549	649	749	849	949
October	930	050	150	250	350	450	550	650	750	850	950
November	931	051	151	251	351	451	551	651	751	851	951
December	932	052	152	252	352	452	552	652	752	852	952

Please give the exact date of manufacture of defective products on all guarantee claims, since this detail is of great importance for quality monitoring and control.

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TEST SHEET FOR FUEL INJECTION PUMPS

VDT-I-Gen. 053 En

10.1982

Instructions for use in after-sales service

Testing and adjusting specifications in test sheets give the customer the values that specialists have stipulated for his fuel-injection assembly and they can be referred to again at a later stage if required.

Great importance is attached to the documentation of testing and adjusting specifications not only as evidence in guarantee cases, but also in individual cases of quality control.

The test sheet is an important item in the quality work of the Bosch after-sales service centers and will be introduced immediately to the after-sales service organization and is to be prescribed for use (example see over).

Application

The test sheet for fuel-injection pumps must be drawn up for all testing and adjusting work carried out on the injection-pump test bench for commercial customers (e.g. vehicle representative organizations, authorities, forwarding agents). The test sheet may also be drawn up and handed in for private customers.

In the case of guarantee claims on injection pumps, providing these concern testing and/or adjusting values, a test sheet should be kept with the guarantee claim form in every case.

The signature of the workshop manager confirms that the vehicle to be tested was in fact tested with the test equipment prescribed by Bosch and that the relevant test regulations were adhered to.

The test sheet (1 pad = 50 duplicating sets) can be ordered in the usual manner by quoting publication no. VDT-W-400/308.

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Test sheet for fuel-injection pumps

VDT-W-400/308-1 En

BOSCH DIENST BOSCH SERVICE

Customer ______________ Order no. ______________

Pump ______________ Assembly no. ______________ Tested on ______________

Governor ______________ Series no. ______________ by ______________

E = Measurement when received, A = Measurement when adjusted

Prestroke E ______ mm at ______ mm RT
A ______ mm

Cam sequence: ______________

Angular cam spacing: E ______________ °camshaft
A ______________ °camshaft

Delivery quantity	n min⁻¹	RT mm	LDA p bar		Delivery quantity (FM) cylinder (cm³/1000 strokes) 1	2	3	4	5	6	7	8	9	10	11	12	FM scattering
Full load				E													
				A													
Delivery characteristics				E													
				A													
				E													
				A													
				E													
				A													
Idle				E													
				A													
Start				E													
				A													

Breakaway	E	at min⁻¹ mm RT less than at full load	torque-control travel mm RT
	A	at min⁻¹ mm RT less than at full load	torque-control travel mm RT

Manifold-pressure compensator (LDA)	E	at bar mm RT	at bar mm RT	at bar mm RT
	A	at bar mm RT	at bar mm RT	at bar mm RT

Distributor-type fuel-injection pump

FM = Delivery quantity RT = Control-rod travel

Timing-device travel	E	at min.⁻¹ mm	at min.⁻¹ mm	at min.⁻¹ mm
	A	at min.⁻¹ mm	at min.⁻¹ mm	at min.⁻¹ mm
Supply-pump pressure	E	at min.⁻¹ bar	at min.⁻¹ bar	at min.⁻¹ bar
	A	at min.⁻¹ bar	at min.⁻¹ bar	at min.⁻¹ bar
Overflow quantity	E	at min.⁻¹ cm³/10s		at min.⁻¹ cm³/10s
	A	at min.⁻¹ cm³/10s		at min.⁻¹ cm³/10s

Breakaway	E	at min.⁻¹ cm³/1000 strokes
	A	at min⁻¹ cm³/1000 strokes

Judgment/remarks: ______________

____

____

Date, signature of examiner

Company stamp

Signature of workshop manager

BOSCH

J18 AS

ISO CALIBRATING OIL FOR FUEL-INJECTION PUMPS

VDT-I-Gen. 055 En

12.1982

The new microcards WP-00 etc. were sent out in October 1982. When you receive these microcards, which are distinguished by a pink head band and the ISO symbol, you should throw away the old set WP .. with violet color band.

Changes have been made, in particular, to the test specifications of those types of pump which are still being produced as standard equipment.

The specifications for the following types have not been changed:-

PE(S) .. B .., EP/VM .., PF ..Z.., .. C(V) .., ..D(V).., ..W..
All pumps with V numbers,
Schäfer (Kugelfischer) pumps (gasoline and diesel) and
FIAT pumps (Bosch licence).

Specifications for the following types can only be changed gradually:-

PE(V)..Z (WM).., PE..CW.., PE..Y.. and
SIGMA pumps (separate microcards)

For setting the gasoline injection pumps
ZEA/ZEB 2 KL.., PES..KI.. and PED 6 KL..the existing test specifications for 40° are used but the ISO calibrating oil is heated to only 20° C.

If test specifications should be required for a fuel-injection pump of the above mentioned types, these can be made available on request.
Telex address: 72 66 808 jco d.

Q-values stamped onto additional nameplates without ISO designation apply to the calibrating oil used up till now OL 61 v 11.

Mixing of ISO calibrating oils of different manufacturers is not permitted, because of the alloying constituents with different additives which cannot be chemically mixed.

The existing procedure of mixing special oils with gasoline or diesel fuel is no longer permitted either, because the viscosity of such mixtures is often very different from that of the ISO calibrating oil.

TELEPHONE ENQUIRIES ABOUT TEST SPECIFICATIONS FOR INJECTION PUMPS

VDT-I-Gen. 057 En
3.1983

040 ..
041 ..
042 ..
046 ..

There has recently been a considerable increase in enquiries and demands for test specifications for fuel-injection pumps and governors. The following regulation has therefore been introduced and will apply until further notice:

1. Enquiries about test specifications can be directed to KH/VSK in Wernau, Tel: 07153/63-623 (automatic telephone answering service).

2. Experience has shown that answering enquiries with the cooperation of various departments often takes several hours. Answers to enquiries can therefore be made at the earliest during the afternoon of the day in question.

This time delay must be taken into account especially when a fuel-injection pump is being timed again after repair work. It would therefore be of considerable assistance if a check could be made before each period of repair work, to see if the test specifications are in the microcards. If they are missing, they can then be ordered immediately.

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VDT-I-Gen. 066 En

5.1984

VISCOSITY TESTING OF CALIBRATING OIL ISO 4113 FROM INJECTION-PUMP TEST BENCHES

The accuracy of testing and setting operations on injection pumps is dependent not only on the care and attention of the tester and on the proper condition of the test bench and accessories, but also on the calibrating fluid.

Test specifications for Bosch fuel-injection pumps are based exclusively on the calibrating oil to ISO Standard 4113 and are only reproducible in the service workshop if, among other things, the viscosity of the calibrating oil is within the limits laid down in the aforementioned standard.

The kinematic viscosity of the calibrating oil must, in accordance with ISO Standard 4113, be 2.45 cSt to 2.75 cSt (1 cSt = 1 mm²/s) at a temperature of 40°C. If, as a result of contamination, the viscosity of the calibrating oil is changed such that the limits of 2.45 cSt and 3.00 cSt are fallen below or exceeded respectively, the calibrating oil must be renewed.

For the above-mentioned reasons, therefore, Bosch diesel service workshops must, with immediate effect, regularly check the viscosity of the calibrating oil.

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Checking must be performed once a week according to ISO Standard and must be repeated no later than after testing or setting 20 injection pumps (corresponds on average to about 35 operating hours). If no injection pumps or fewer than 20 have been tested checking must take place after no later than 6 months.

Checking is performed with the aid of viscosity tester KDEP 1500 which can be purchased through the usual channels. You have the corresponding offer sheet.

The viscosity tester KDEP 1500 is supplied with the following accessories:

- Viscosity test beaker
- Collector vessel with lid
- Thermometer with protective hose and holder

The viscosity is checked by measuring the allowable drain time which the calibrating oil needs to drain from the viscosity test beaker through a calibrated bore. Taking account of the prevailing temperature of the calibrating oil, the measured time is compared with a nominal drain time listed in a table. If the measured drain time is outside tolerance, the calibrating oil must be renewed.

Precise instructions on testing are enclosed with viscosity tester KDEP 1500, and are also contained on SIS microfiche W-Gen./7.

- Please direct questions and comments concerning the contents to our authorized representative in your country.

40...46, 58
VDT-I-Gen. 074 En
8.1985

CALIBRATING OIL TO ISO 4113
FOR DIESEL FUEL-INJECTION PUMPS
Notes on use of calibrating oil

Calibrating oils approved by Bosch:

- Shell Calibration Fluid S 9365 (Shell International)
- Shell V oil 1404 (Shell Germany)
- Shell Norma fluide B. R. (Shell France)
- Viscor Calibration Fluid 1487 AW (Viscosity Oil)
- Castrol fluido para Calibracao 4113 (Castrol Brazil)

C A U T I O N :
Oils from different suppliers must not be mixed.

Keep containers tightly sealed in a well ventilated place.

BOSCH Geschäftsbereich KH Kundendienst Kraftfahrzeug Ausrüstung

J23

When working - particularly at the injection-pump test bench:

- No eating, drinking or smoking.

- Do not inhale vapors.

- The workplace/working space must be well ventilated. Prolonged inhaling of vapors may cause intoxication or headache.

  Treatment:
  Fresh air, possibly use of oxygen, do not administer any cardiovascular drugs.

- Prolonged contact with the skin may lead to skin rashes in sensitive persons.

  Treatment:
  Wash hands as frequently as possible and use protective skin cream or protective gloves.

- If oil comes into contact with eyes, clear with running water for several minutes.

- If wetted with oil, remove clothing immediately.

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CALIBRATING OIL TO ISO 4113 FOR DIESEL FUEL-INJECTION PUMPS

Wear prevention

Calibrating oils approved by Bosch:

- Shell Calibration Fluid S 9365 (Shell International)
- Shell V-Oil 1404 (Shell Germany)
- Shell Norma fluide B. R. (Shell France)
- Viscor Calibration Fluid 1487 AW-2 (Viscosity Oil)
- Castrol fluido para Calibracao 4113 (Castrol Brazil)

Only these calibrating oils guarantee at present the wear prevention we require.

Wear prevention is of utmost importance for distributor-type injection pumps. Our investigations provide clear, always demonstrable proof that the use of calibrating oils, whose wear prevention does not conform to our conditions, can lead to friction wear when running in the pumps both after production and after repairs. Depending on the loading of the pump in subsequent service, this may result in premature failure of the pump.

J25

Other companies, e.g. Daimler-Benz AG, release calibrating oils which do not meet our strict wear-prevention conditions.
The reason:
Daimler-Benz AG does not install any distributor-type fuel-injection pumps in its vehicles. Calibrating-oil advertising concerning the release given by Daimler-Benz ought, therefore, to be restricted to in-line pumps unless it wishes to avoid the actual technical problem.

To guarantee our quality standards also at after-sales service level, we hereby make it a binding requirement that only calibrating oils released by us be used. We reserve the right to check this when warranty damage is reported on distributor-type pumps. Warranty claims will be rejected if failure is due to wear and a calibrating oil not released by us has been used.

Published by:

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After-Sales Service - Warranty (KH/VKD 3)

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CALIBRATING NOZZLE-AND-HOLDER ASSEMBLIES WITH PERFORATED PLATES

VDT-I-Gen. 1002 En
09.1985
supersedes 11.1984
supersedes I-400/1001, /1002
I-460/1002

The ever higher requirements regarding the accuracy of setting and testing can only be met using test equipment which guarantees hydraulic characteristics as close as possible to those pertaining on the engine as regards opening pressure, volumetric flowrate and line length.

For these reasons, it has been necessary to specify new calibrating nozzle-and-holder assemblies.

This concerns injection-pump assemblies with in-line pumps of sizes MW and P as well as VA and VE distributor-type pumps.

The following calibrating nozzle-and-holder assemblies have now been introduced for use when setting and testing the injection-pump models concerned:

Cal.nozzle + holder assy	Perforated plate ø mm	Part No.	set pressure (bar)	for use with
1 688 901 016	0.5	1 680 103 095	207+3	MW, VE
1 688 901 017	0.6	1 680 103 096	207+3	P
1 688 901 019	0.8	1 680 103 098	207+3	P
1 688 901 020	0,6	1 680 103 096	172+3	VA, VE
1 688 901 023	0.4	1 680 103 094	172+3	VE
1 688 901 025	0.5	1 680 103 095	172+3	PF (R)..K.

The part nos. for the corresponding single-hole nozzles are:
1 688 901 999 for nozzle-and-holder assy 1 688 901 016,
..017,
..019,
..020,
1 688 901 991 for nozzle-and-holder assy 1 688 901 023
and ..025

The various calibrating nozzle-and-holder assemblies can be converted by changing the perforated plates and changing the setting of the opening pressure.
The tightening torque for the nozzle-retaining nut is 60 - 90 Nm.
Conversion should, however, only be performed in exceptional cases.
It should be noted in this respect that calibrating nozzle-and-holder assemblies are very sensitive components of the entire test equipment and require utmost cleanliness when working as well as very precise setting of the nozzle-opening pressure.

The calibrating nozzle-and-holder assembly specified for the testing of fuel-injection pumps is listed on microcard SIS-W-Gen./7 or on the respective test-specification sheet.

The designation of the specified calibrating fuel-injection tubing is normally also to be taken from microcard SIS-W-Gen./7.
In special cases, it is listed on the test-specification sheet together with the applicable nozzle-and-holder assembly.

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Injection-Pump Test Bench Conversion to Flywheel 1 686 609 057

In order to mount the larger flywheel 1 686 609 057 (see also VDT-W-400/305) on the drive shaft of the injection-pump test benches EFEP 375.., 410.., 385.. and 390.., the suction line, discharge tubing and vacuum connections must be repositioned. (Items 5, 6 and 7 in Figure 1)

1. Removal of the connecting parts

1.1 Test-oil inlet - Item 6:

Remove the hose fitting on the control valve; the fitting is accessible above the oil motor after taking off the rear wall of the test-bench housing. After unscrewing the 3 countersunk-head screws, the pipe bend together with the hose can be pulled out through the hole.

1.2 Suction-line connector - Item 5:

After unscrewing the 3 countersunk-head screws, remove the pipe bend, loosen-off the hose connector and pull off the plastic hose.

1.3 Vacuum connector - Item 7:

Unscrew the countersunk-head screws, loosen-off the hose connector and pull out the hose.

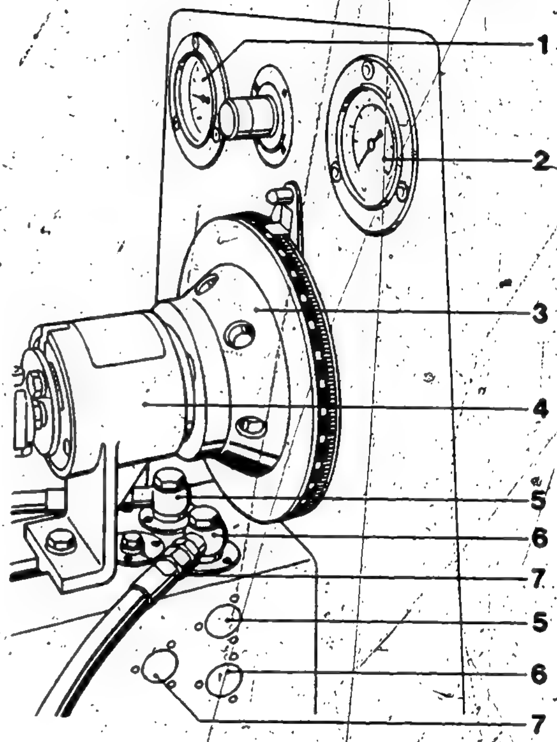

Figure 1 Front side of the upper part of the test bench

1 Thermometer
2 Pressure Gauge
3 Graduated disc
4 Backlash-free clutch
5 Suction-line connector
6 Pressure-line connector (Test-oil inlet)
7 Suction-line connector (Blank off when not used)

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K2

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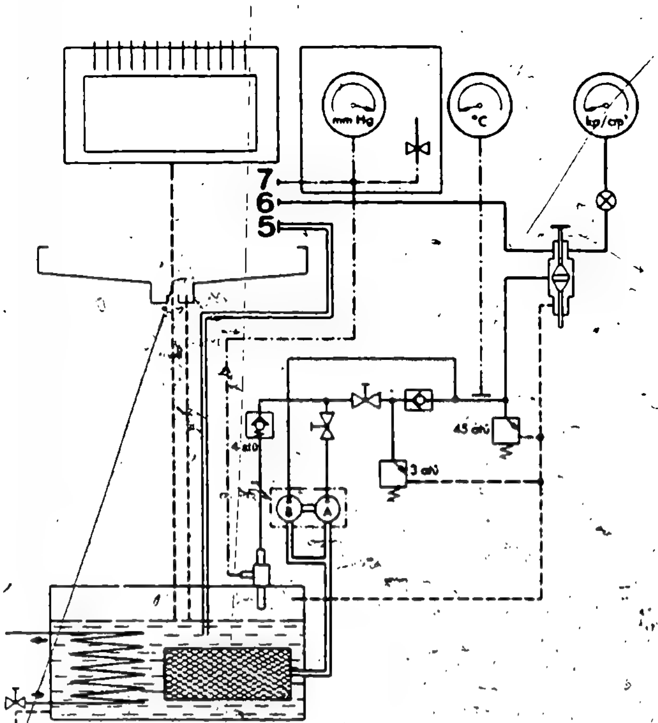


Figure 2 Line schematic

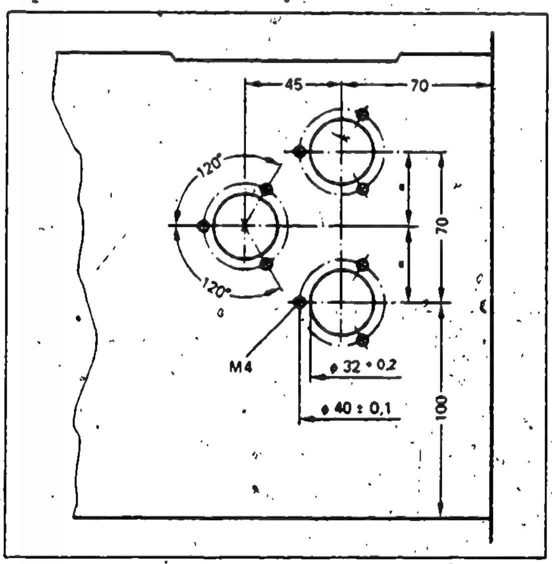


Figure 3 Drilling dimensions

2. Drilling the new conector openings

(Use flange as marking template)

The 32 mm dia. holes (cut using a spot facer), and the M 4 tapped holes, are to be located on the operating side of the test bench which experience has shown to be used the most. During drilling, beware of electric cables, it might even be abvisable to lock the push-button switch and remove the fuses.

3. Modifying the pipe bends

Modify both pipe bends, for test-oil inlet and for suction-line connector, in accordance with Figure 4 so that they fit during reassembly. Shorten them as shown in Figure 4 and re-solder (braze).

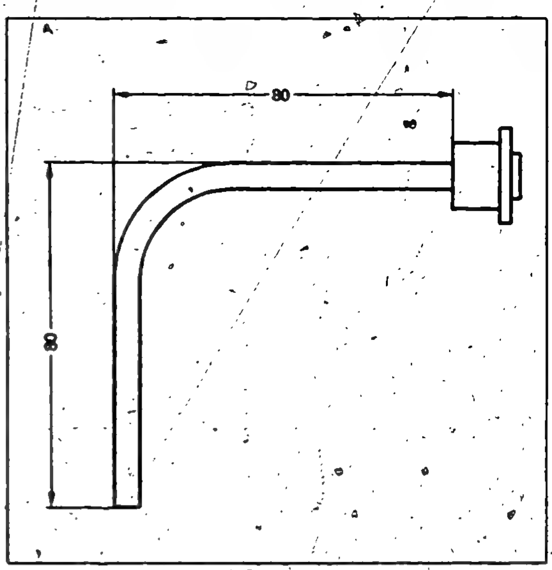


Figure 4 Modify pipe bend

4. Reassembling the connecting parts

Assemble in the order given under 1, e.g. connect the hose which leads to item 6 with the pipe bend and insert it in the hole prepared; secure with the countersunk-head screws.
Items 5 and 6 in accordance with 1.
Blank off the holes on the upper side with appropriate cover plates.

5. Remove and replace the flywheel

The flywheel is secured to the drive shaft with hexagon-head screw, washer and keyway. After removing the multi-plate clutch, unscrew the hexagon-head screw and pull off the old flywheel.
The new flywheel is fitted in the reverse order. Check for true running (maximum deviation: 0.03 mm).

INSTALLATION INSTRUCTIONS FOR RUNNING-TIME METER IN INJECTION-PUMP TEST BENCHES

VDT-I-400/1004 En
4.1984

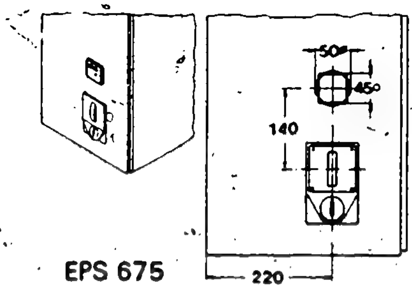
For proper maintenance at regular intervals it is necessary to record the operating time of injection-pump test benches by means of a running-time meter. The instructions apply to the installation of running-time meters 220 V, 50 Hz, Part No. 1 687 233 092 and
220 V, 60 Hz, Part No. 1 687 233 094
in injection-pump test benches EPS 270
EFEP 500
EFEP 500 A
EFEP 515
EFEP 615
EFEP 615 A
EPS 675
and their S-versions.

The running-time meters can also be installed and appropriately connected in older, non-listed test benches. The running-time meters are to be ordered directly from the manufacturer quoting the Bosch part number:

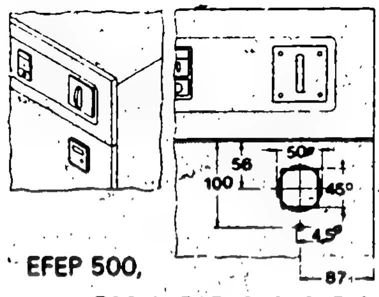
Fritz K ü b l e r
Zählerfabrik GmbH
Postfach 3440
7330 Villingen-Schwenningen

BOSCH Geschäftsbereich KH, Kundendienst Kraftfahrzeug-Ausrüstung

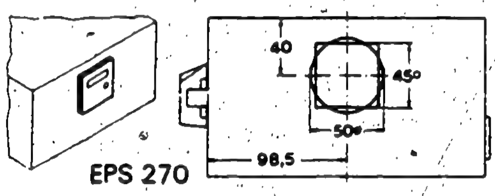
K5



EPS 675



EFEP 500, 500 A, 515, 615, 615 A

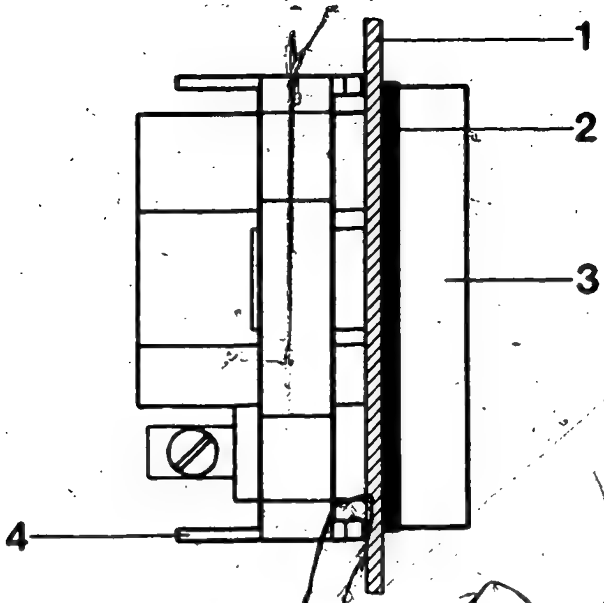


EPS 270

Preparations for installation:
Main switch on injection-pump test bench at "off".
Disconnect control cabinet from the mains.
The running-time meter is installed in the control cabinet. To do this, cut out a hole with a circular cutter (50 mm diameter) or with a keyhole saw (45 x 45 mm). See illustration for installation dimensions.

Electrical connection:
EPS 270: Connect terminal 1 of running-time meter to terminal strip term. 7, and terminal 2 to terminal strip term. 10 of test bench.

EFEP 500, 500A, 515, 615, 615A: Connect terminal 1 of running-time meter to terminal strip term. 1, and terminal 2 to terminal strip term 36 of test bench.



Electrical connection for EPS 675:
Connect terminal 1 of running-time meter to terminal strip term. 1, and terminal 2 to terminal strip term. 38 ~~of test bench~~.
Re-establish mains connection.
Main switch at "ON". Switch on test-bench drive motor and check operation of running-time meter.

Installation:
Slip the enclosed sealing rubber (2) onto meter housing (3). Insert meter into cutout from outside the control cabinet. Slip clamp (4) over detent on meter housing so that housing with sealing rubber (2) is close up against the control-cabinet metal wall (1).

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Division KH
After-Sales Service Department for Training and Technology (KH/VSK)
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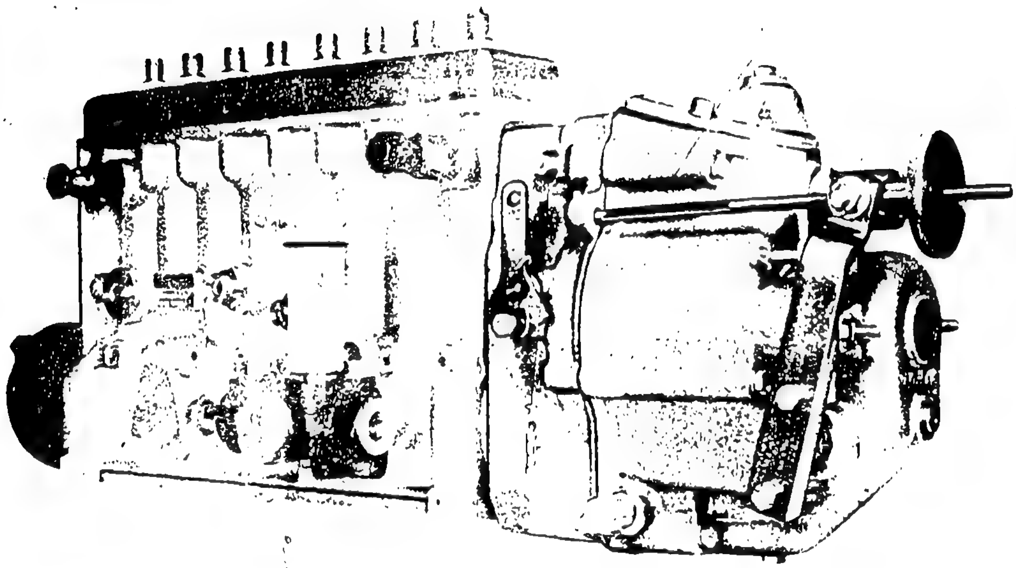
BOSCH

TEST INSTRUCTIONS
EP

VDT-WPP 001/4 B
Ed. 1/Sup. 4



Mechanical Governors

(EP/RZU . . A . .) 0 420 26 . . . .
(EP/RZU . . P . .) 0 421 86 . . . .

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4 2. Testing and adjusting on the injection pump test bench

6 3. Adjustments on the engine

7 4. Diagram of the EP/RZU governor

1. The EP/RZU .. Governor:

Construction, Method of Operation and General Instructions

1.1 Construction

The EP/RZU .. governor is a mechanical speed governor mounted on injection pumps of type A and P of up to 12 cylinders.

The camshaft of the injection pump drives the measuring unit (flyweight unit) through the reduction gears. The reduction ratio of the cam shaft to measuring unit shaft varies as a function of governor speed. To prevent a transmission of rotational drive vibrations to the measuring unit, the flyweight carrier is elastically coupled with the drive shaft by a ball bearing and a torsion spring. Spring-loaded friction pads which vary in number according to governor design, have been installed as vibration dampers. The number of flyweights (2 or 4) also varies according to the required nominal speed.

The measuring unit shaft carries the sliding sleeve for the control linkage in which the fulcrum lever and stabilizer lever have been mounted. The motion of the flyweights is transmitted to the sliding sleeve by a thrust bearing.

The axial motion of the sliding sleeve on the measuring unit shaft is transmitted by the fulcrum lever to the spring-loaded link fork (extension of the fulcrum lever).

The governor spring set is located in the governor cover. The inner spring plate (in the sliding sleeve direction) is designed as a stop cup. Its position can be adjusted with two screws (adjustment screws for full load). This position corresponds to the full load control position. Speed is adjusted by the fork-type speed control lever which rests on the outer spring plate.

The spring of the Percent Regulation (P-Regulation) control is installed in the governor housing over the control rod, and is hooked to the control rod and acts parallel to the governor springs. By changing the effective number of spring turns, a limited correction of the P-regulation (formerly 'speed droop') up to ± 1% is possible.

The stabilizer is located in the oil pan of the governor. It consists of a cylinder with a piston and a spring hooked to the piston. The other end of the spring is connected to the stabilizer lever. The space between the piston and cylinder is connected to the oil pan through a throttle bore, the cross section of which can be altered with a throttle screw.

1.2 Method of Operation

With the engine stopped, the control rod is pulled to the starting position by the fulcrum lever by means of the spring of the P-regulation control. At the same time the sliding sleeve with the thrust bearing is forced against the retracted flyweights. This position of the sliding sleeve results in a starting position of the control rod of about 18.5 mm (with stop for starting quantity disconnected).

After the starting speed is exceeded, the centrifugal force of the flyweights overcomes the tension of the spring in the P-regulation control. The sliding sleeve is thus shifted in the direction of the stop cup and rests on it until the start of break-away (full load control position). The speed (start of break-away) is adjusted with the speed control lever.

Under load, the engine speed drops at first. The flyweights are thus retracted, the sliding sleeve moves the control rod in the „full load" direction by means of the fulcrum lever. The injected quantity thus is increased, so that the set theoretical engine speed is readjusted according to the P-regulation. The process is reversed after the load is removed from the engine.

The time for transition from one control position into the next can be regulated by the stabilizer. The stabilizer can only be adjusted with the engine running. By adjusting the throttle screw (on the outside of the governor housing), it is possible to adjust the regulating behaviour to engine requirements. Naturally, it is assumed that the correct stabilizer spring has been installed (specified in the service parts list).

The stop lever must be operated to stop the engine. The spring of the spring-loaded link fork is compressed and the control rod is pulled to the stop position.

1.3 Lubrication

In operation the governor is connected to the engine lubrication system through the injection pump. The oil is automatically maintained at the proper level. During testing, oil must be added to obtain the specified level (inspection plug). In the governor, oil splashed upwards is collected in a collecting pan over the ball bearing of the measuring unit shaft and is sucked into the latter through an oil-collecting tube. All sliding and rotating parts are supplied with oil centrifugally forced through suitably arranged bores.

1.4 General Remarks about Testing

The repair of the EP/RZU .. governor is described in Repair Instructions VDT-WJP 211/6 B.

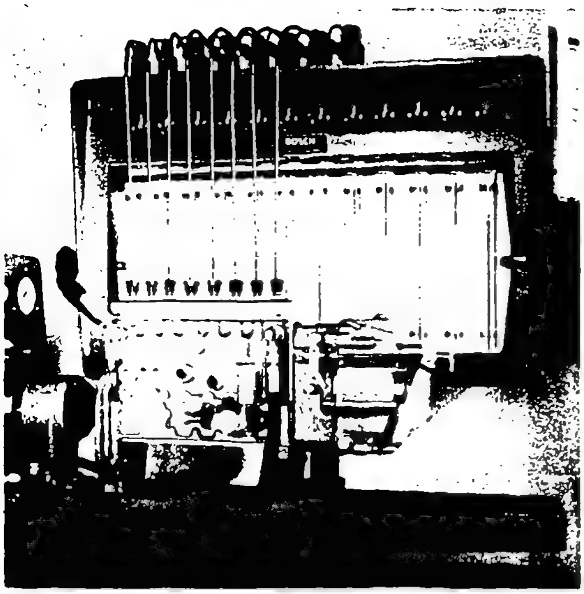
The following instructions describe testing and adjustment of this governor on the injection pump test bench and the possibilities of correcting its adjustment on the engine.

In testing a repaired governor it is assumed that the suggestions contained in the repair instructions were followed and that the correct parts were installed, i. e. as specified in the appropriate service parts list for the respective governor model.

Since the EP/RZU .. governor can be driven with a 0% governor control (degree of regulation) it is important that speed jumps while testing the control rod travel in the break-away range should be very small. This requirement can only be satisfied with a highly efficient injection pump test bench where the speed remains uniform during load changes.

No special tools are needed for testing the governor except for the mounting fittings and control rod travel measuring instruments specified for the respective pump model.

2. Testing and Adjusting on the Injection Pump Test Bench

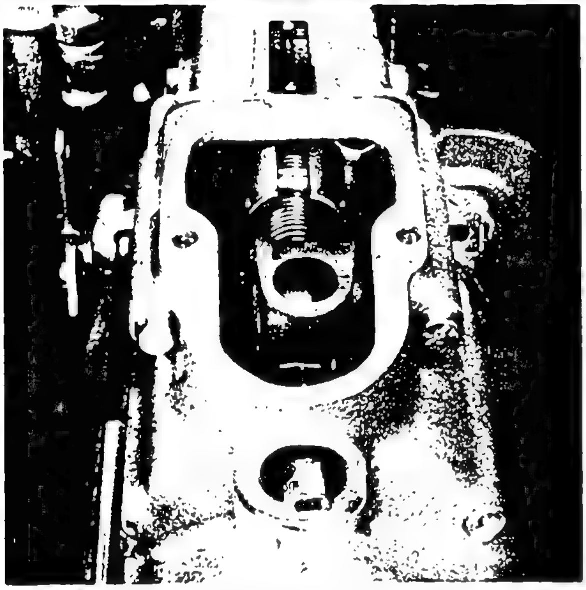


1

2.1

Install injection pump with attached governor on test bench.

If control rod stop (starting quantity limit) is present, remove it from the injection pump.



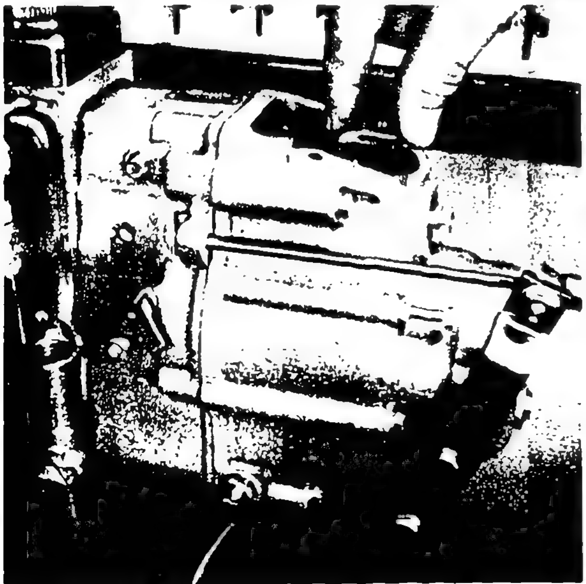
2

2.2

Unscrew small cover on governor cover and crown nut for the spring-loaded link fork.

Preset adjusting disc of the P-regulation control to approx. one half of spring length.

Preset adjusting nut of the spring-loaded link fork so that the counter nut is flush with the threaded bolt.



3

4

2.3

Add lubricating oil (as in the engine) until it flows out of the overflow bore in the governor cover.

Important: Common oil supply for pump and governor. Never test with insufficient oil.

Vent stabilizer:

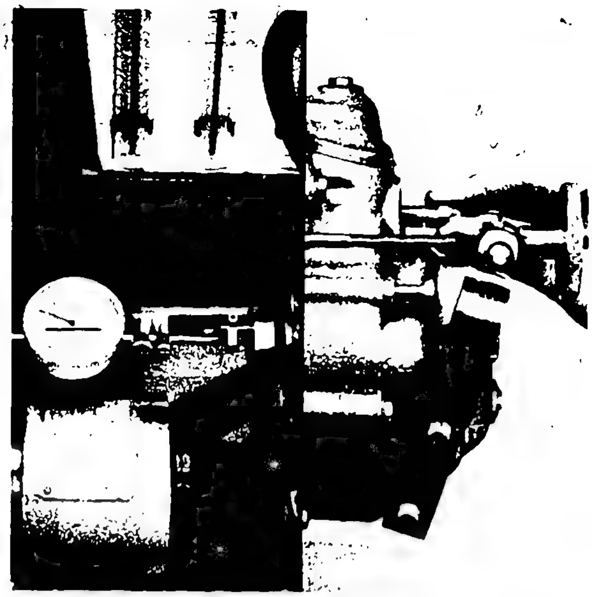
Open throttle screw by a few turns. Move stabilizer lever back and forth approx. 10–20 times and slowly close throttle screw. A resistance must be felt at the stabilizer lever when the throttle screw is closed.

Open throttle screw by one turn and lock with counter nut and crown nut. (Do not forget gaskets!).

Replace small cover on governor cover but do not tighten fastening screws. The ball head must be seated in the stabilizer lever.

2.4
Attach measuring device for the control rod travel to the injection pump and set dial gauge to zero with the control rod in stop position. To obtain the stop position (Fig. 4), pull back control rod further at the spring-loaded link fork.

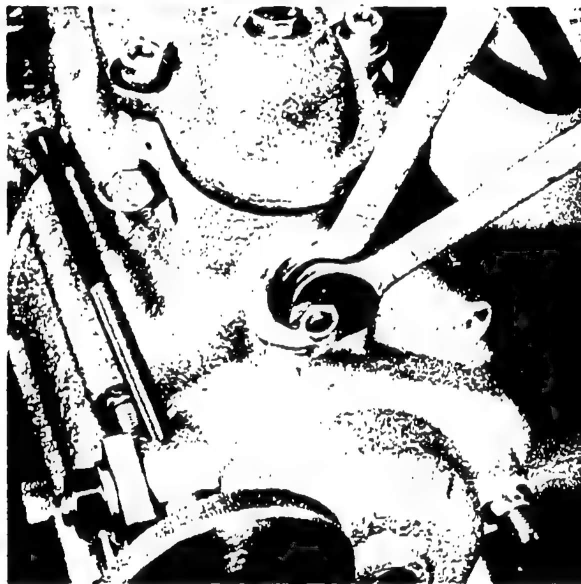
4



2.5
Drive pump at nominal speed and tighten both fastening screws of the cover. Apply sufficient tension on the control lever so that the governor starts to break-away at nominal speed.

Increase speed until the governor has completely shut down. Set adjusting nut on the spring-loaded link fork so that the control rod is 1 mm from the stop. Maintain this dimension at all times (Fig. 5).

5



2.6
Adjust full load quantity according to test instructions, par. C, columns 1 and 2. If no information is available, the following applies:
Set speed = 5 rev/min below nominal speed,
Control rod travel = 10.5 mm.

Adjust by uniformly setting the two adjusting nuts in the governor cover. A clockwise rotation leads to a larger quantity and longer control rod travel; counterclockwise rotation has the opposite effect.

The following must be kept in mind during adjustment:
In the full load range the sliding sleeve rests on the stop cup in the governor cover. Parallel position of the stop faces depends on the position of the stop cup and thus on the uniform adjustment of the two full load stop screws. A poor, nonuniform contact results in an imprecise and hesitant start of break-away which can be observed on the dial gauge of the control rod travel measuring device.

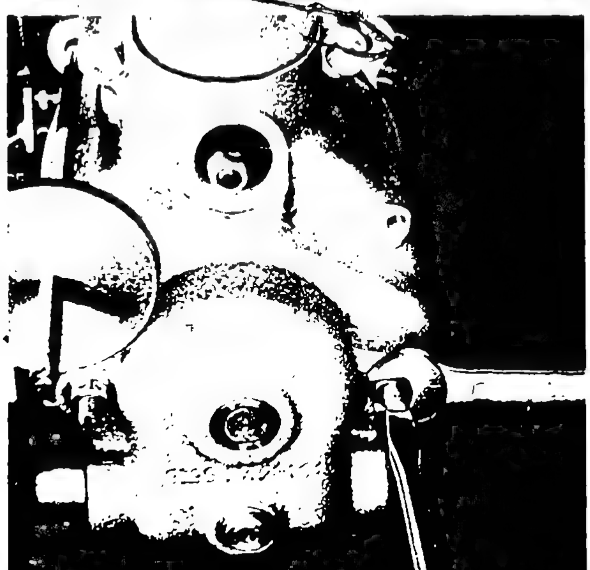
For checking and possible correction, increase the speed slowly until break-away occurs (sliding sleeve rests on the stop cup, the two adjustment nuts are unloaded).

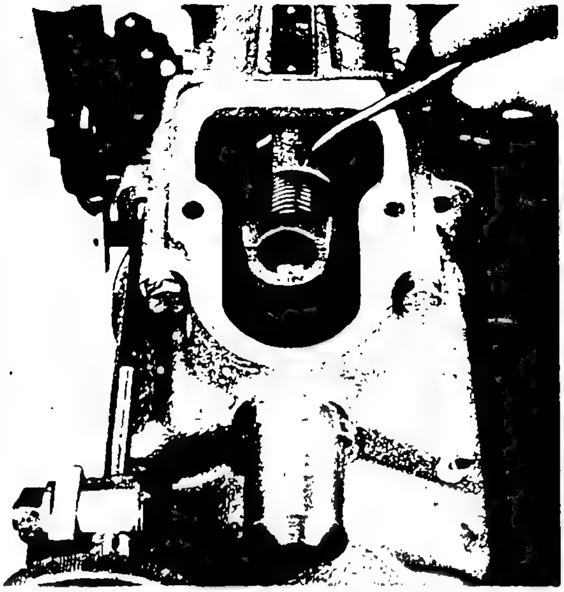
Adjust both adjustment screws with a finger- tip control until they just rest on the tongues of the stop cup.

Recheck and, if necessary, correct the position of the control lever (start of break-away) and full load adjustment

Note: Any adjustment of the full load adjustment screws results in a change in pretension of the governor springs. Consequently, the start of break-away must be readjusted after each adjustment (Fig. 6)

6





7

2.7
Check control rod travel according to test instructions, par. B, columns 2 and 3. Note that from n = 250 rev/min to 5 rev/min below nominal speed the control rod travel is allowed to decrease steadily by a total of 0.4 mm and an additional 0.4 mm up to nominal speed. Then break-away must occur efficiently and without jerks in accordance with specified values.

The break-away values in the test instructions correspond to the required P-regulation of the governor (degree of regulation). If these values are not reached, a limited correction can be made on the P-regulation control. Adjustment is made with a pin (4 mm dia.) by rotating the adjustment bushing. Clockwise rotation (viewed from governor towards pump) results in a decrease of the P-regulation; counterclockwise rotation has the opposite effect.

If the specified values cannot be obtained, it will be necessary to check whether the correct set of governor springs have been installed.

Note: Adjustments on the P-regulation control only to be made with the pump stopped.

2.8
Operate stop lever with pump stopped and check for zero control rod travel.

2.9
Seal counter nuts of the full load adjustment screws, control lever stop screw and crown nut for spring-loaded link fork with sealing wire and lead seals.

3. Adjustments on the Engine

3.1
The full load quantity may be adjusted on the engine up to a control rod travel tolerance of ± 0.5 mm by resetting the single nut on the spring-loaded link fork. The position of the control rod remains the same.

3.2
Changes in full load quantity which exceed the range mentioned in par. 3.1 must be made on the two full load adjustment screws. In this case, it will also be necessary to readjust the control lever position (start of break-away).

3.3
Close throttle screw of stabilizer with the engine running until stability and optimum control characteristics have been obtained.

3.4
If necessary, the P-range (degree of regulation) can be readjusted within limits on the injection unit installed on the engine. Adjustment at the P-regulation control (see par. 2.7).

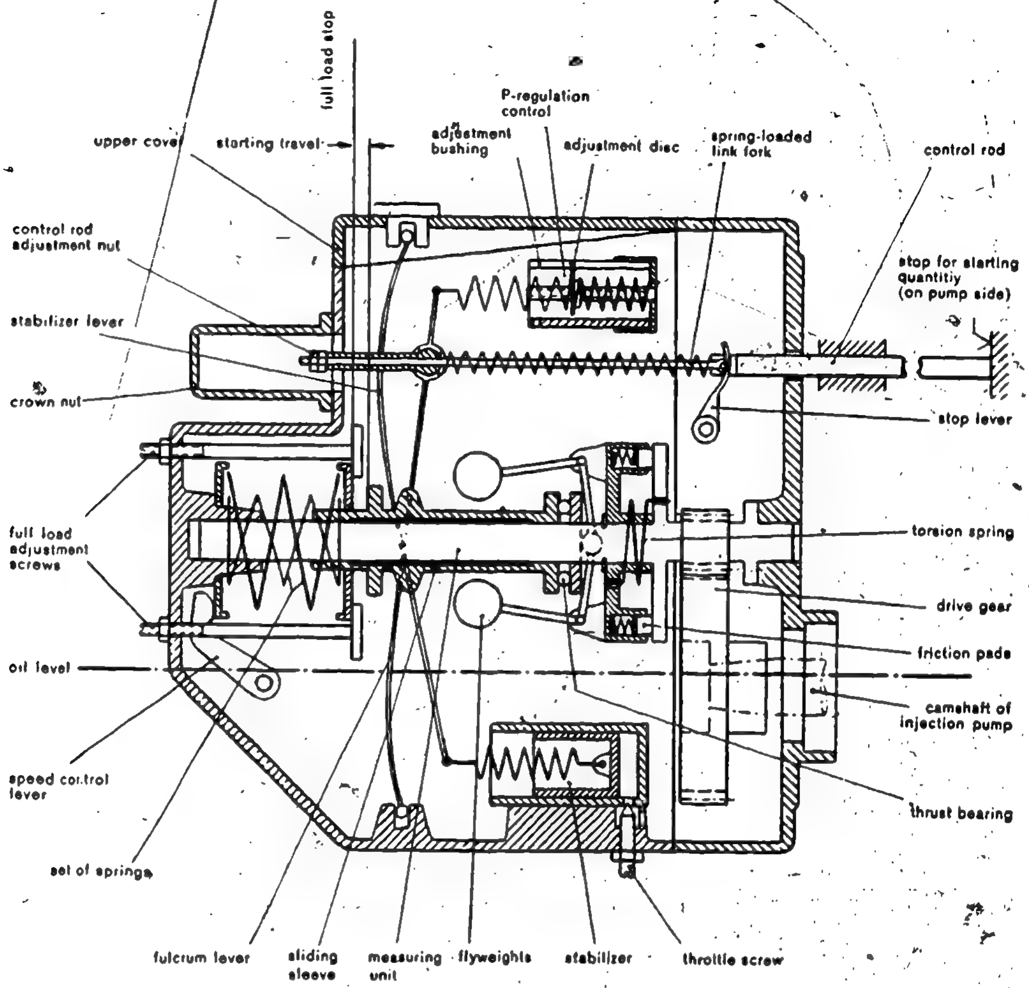
Make adjustments only with engine stopped!

Exact determination of the adjusted P-range is possible only with the governor body completely closed because only then do the operating pressure conditions exist in the governor.

3.5
Final sealing of the governor (see par. 2.9).

4. Diagram of the EP/RZU governor

(in the stopped position)



After-sales Service Instructions

Testing

42

VDT-W-420/1000 B
Ed.2
replaces VDT-WPP 211/2

RQ-type Governors for injection pumps

Index of test-specification sheets

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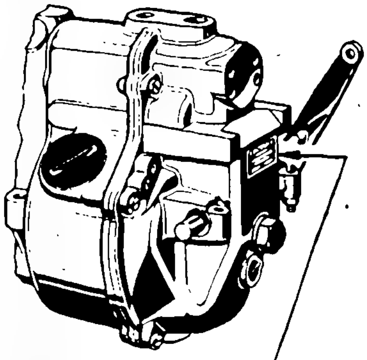
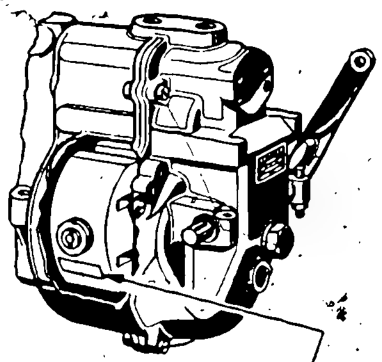
1. Beispiele für das Aufsuchen der Prüfwerte eines RQ-Reglers
1. Example for looking up the test specification of a governor type RQ
1. Exemple pour trouver les valeurs d'essai d'un régulateur RQ
1. Ejemplo para buscar los valores de ensayo para un regulador RQ



RQ 250/1400 A.14



1 8100 000

Ersatzteilliste bzw. Mikrokarte für:
Spare Parts:
Pièces de rechange:
Piezas de recambio:

RQ .. A .. = VDT-EVP 211/7 X EP-41 ..
AA .. = 211/29 X EP-41 ..
AB .. = 211/39 X EP-42 ..
B .. = 211/13 X EP-43 ..
P .. = 211/36 X EP-43 ..

2. und 3. Stelle der Bestellnummer fehlen hier.
2nd and 3rd place figures of the part number are not given here.
Le 2ème et le 3ème chiffre des références ne sont pas donnés ici.
2ª y 3ª cifra de los. nos de pedido se omiten aquí.

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2. Governor types and the corresponding test specification sheets
2. Les différents régulateurs et les feuilles d'essai correspondantes
2. Los diversos reguladores y los valores de ensayo correspondientes

Regler RQ 250 A		Reglerteil Bestellnummer 1 428	siehe VDT WPP 211/
250/1400	A 14 15 20 26 82	100 000	21 1

Prüfwerteblatt
Test-specification sheet
Tableau de valeurs d'essai
Hoja de valores de ensayo

Prüfwerte Fliehkraftregler 42

VDT - WPP 211/21 - 1

2. Ausgabe
ersetzt 10 67

Fliehkraftregler RQ A..
RRG 1 428 100 000.. .011

RRG 1 428 100 000 → RQ 250/1400 A

1	2	3	4	5	6	7	8	9	10	11	12
500	15,7-16,3	500	16	1400 1440 1480 1550	15,6-16 8-13,5 0-9 0	520	0	100 200 300 420	6,2-8,2 4,5-6,7 2-4,5 0	-	-

Anleitung zum Prüfen siehe VDT-WPP 001/4
Instructions for testing see VDT-WPP 001/4 B
Instructions pour l'essai voir VDT-WPP 001/4 F
Instrucciones para el ensayo véase VDT-WPP 001/4 SP

Weitere Hinweise siehe Seite 11
For further hints, see page 11
Autres détails, voir page 11
Otros detalles véanse pág. 11

W-42014000

2. Regler-Ausführungen und zugehörige Prüfwerte-Blätter
2. Governor types and the corresponding test specification sheets
2. Les différents régulateurs et les feuilles d'essai correspondantes
2. Los diversos reguladores y los valores de ensayo correspondientes

Beachten:
Bei Reglern mit besonderen Angaben in Spalte 1 – 4 der Prufwerte-Tabellen (z.B. „Abregelbeginn" und „VH ca. 49°") handelt es sich um RQ-Regler mit RQV-Reglerhebel und -Lagerbolzen.
Prüfanleitung ist VDT-WPP 001/4, 8. Nachtrag.

Note:
Where there are special remarks in columns 1 – 4 of the test specification table (e.g. "breakaway" and "control lever approx. 49°") the governors concerned are RQ-governors with RQV fulcrum lever and pin.
Test instructions are given in VDT-WPP 001/4 B, Suppl. 8.

Observation
Les régulateurs affectés de données spéciales dans les colonnes 1 à 4 des tableaux de valeurs d'essai (p.ex.: "début de la coupure" et "levier de réglage env. 49°"), sont des régulateurs RQ avec levier de réglage et axe d'articulation de régulateur type RQV.
Les instructions d'essai correspondantes sont: VDT-WPP 001/4 F, Suppl. 8.

Observación
Los reguladores afectados de datos especiales en las columnas 1 a 4 de las tablas de valores de ensayo (p.ej. "comienzo de la regulación limitadora" y "palanca de regulación aprox. 49°"), son reguladores RQ con palanca de regulación y bulón pertenecientes al tipo RQV.
Las instrucciones de ensayo correspondientes son: VDT-WPP 001/4 SP, Supl. 8.

Regler RQ 200 .. A ..		Regelteil Bestellnummer 1 428 ...	siehe VDT-WPP 211/..
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	A 647	100 024	21-3
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N-420/1000

Regler RQ 250 .. A ..		Regelteil Bestellnummer 1 428 ..	siehe VDT-WPP 211/..
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	A 307 D, 402 D	110 069	22-6
	A 325 D, 432 D, 567 D	110 058	22-6
	A 415 D	110 015	22-2
	A 470 D	110 040	22-4
	A 606 D	110 080	22-7
	A 717 D, 730 D	110 136	22-12
	A 839 D	110 172	22-15
	A 869 D	110 180	22-16
250/1200	A 14, 256, 431	100 025	21-3
	A 653, 749	100 018	21-2
	A 662	100 021	21-2
	A 686	100 019	21-2
	A 849	100 027	21-3
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250/1250	A 284, 365	100 009	21-1
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	A 312 D	110 027	22-3
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	A 483 D	110 046	22-4
	A 575 D	110 132	22-12
	A 581 D	110 063	22-6
	A 645 D	110 092	22-8
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	A 734 D	110 157	22-14
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250/1250	A 832 D	110 171	22-15
	A 833 D	110 159 (2)	22-14
	A 845 D	110 177	22-16
250/1275	A 261 D, 485 D	110 004	22-1
	A 311 D, 344 D	110 066	22-6
250/1300	A 662	100 017	21-2
	A 686	100 020	21-2
	A 686	100 026	21-3
	A 500 D	110 087	22-8
	A 575 D	110 075	22-7
	A 590 D	110 083	22-8
	A 639 D, 663 D	110 089	22-8
	A 646 D	110 094	22-9
	A 665 D, 685 D	110 104	22-9
	A 674 D, 675 D	110 108	22-10
	A 745 D	110 143	22-13
	A 833 D	110 183	22-16
	A 862 D, 863 D	110 179	22-16
250/1325	A 575 D, 734 D	110 119	22-11
	A 677 D	110 114	22-10
	A 697 D	110 124	22-11
	A 716 D	110 135	22-12
	A 790 D	110 156	22-14
	A 806 D	110 160	22-14
250/1350	A 196 D, 645 D	110 093	22-8
	A 261 D, 463 D, 485 D	110 033	22-3
	A 881 D	110 182	22-16
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	A 19 D	110 049	22-5
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	A 605 D, 704 D	110 081	22-7
	A 671 D	110 107	22-10
	A 672 D	110 106	22-10
	A 677 D	110 111	22-10
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	A 741 D	110 141	22-12
250/1425	A 490 D	110 003	22-1
	A 572 D	110 055	22-5
250/1450	A 19 D	110 014	22-2
	A 19 D	110 061	22-6
250/1500	A 19 D, 222 D, 302 D, 327 D	110 052	22-5
	A 146 D	110 031	22-3
	A 322 D	110 088	22-8
	A 368 D, 875 D	110 050	22-5
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Regler RQ 175 .. B ..		Regelteil Bestellnummer 1 428 ..	siehe VDT-WPP 211/..
175/1000	B 660 D	130 012	28-1
Regler RQ 200 .. B ..			
200/900	B 286, 291	100 006	25-1
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	B 647 D	130 004	28-1
250/1000	B 646 D	130 003	28-1
250/1025	B 646 D, 654 D	130 005	28-1
250/1050	B 623 D, 643 D	130 007	28-1
	B 656 D, 658 D	130 010	28-1
	B 657 D, 659 D	130 011	28-1
250/1075	B 649 D	130 008	28-1
	B 651 D	130 009	28-1
250/1100	B 326, 337, 357, 369, 373, 377, 387	100 001	25-1
250/1150	B 661	120 001	27-1
Regler RQ 300 .. B ..			
300/650	B 286	100 007	25-1
300/900	B 650 D	130 006	28-1
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175/1000	P 51 D	110 012	26-1
	P 80 D, 87 D	110 022	26-2
	P 137 D	110 038	26-3
175/1100	P 211, 218	100 029	25-3
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200/1000	P 17, 40, 98	100 002	25-1
	P 24, 40	1000 000	25-1
	P 121	100 018	25-2
200/1050	P 55 D, 67 D	110 015	26-1
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	P 17, 17, 24	100 004	25-1
	P 67 D	110 024	26-2
	P 121	100 019	25-2
	P 126	100 020	25-2
	P 126 D	110 033	26-3

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Regler RQ 275 .. A ..		Regelteil Bestellnummer 1428 ..	siehe VDT-WPP 211/..
275/1100	A 865 D	110 173	22-15
275/1200	A 865 D	110 174	22-16
275/1300	A 856	100 028	21-3
	A 892 D	110 891	23-1
275/1325	A 798 D	110 163	22-15
	A 865 D	110 175	22-16
275/1400	A 694 D, 798 D	110 123	22-11
	A 694 D, 798 D	110 168	22-15
Regler RQ 300 .. A ..			
300/950	A 895 D	110 186	22-17
300/1100	A 772 D	110 185	22-16
300/1125	A 713 D	110 129	22-11
	A 779 D	110 154	22-14
300/1175	A 599 D	110 085	22-8
	A 658 D	110 110	22-10
300/1250	A 812 D	110 166	22-15
300/1275	A 577 D	110 103	22-9
	A 658 D	110 109	22-10
	A 713 D	110 130	22-12
	A 779 D	110 155	22-14
300/1325	A 577 D	110 070	22-7
	A 600 D	110 099	22-9
	A 658 D	110 102	22-9
300/1400	A 58, 76, 134, 406, 442, 570	100 003	21-1
	A 93 D, 441 D	110 006	22-1
300/1425	A 405 D, 454 D	110 059	22-6
	A 572 D	110 062	22-6
300/1500	A 466 D, 571 D	110 897	23-1
	A 723 D	110 892	23-1
	A 725 D	110 893	23-1
	A 727 D	110 895	23-1
Regler RQ 400 .. A ..			
400/1700	A 88 D	110 899	23-1
400/1900	A 448 D	110 898	23-1
400/1950	A 390 D	110 896	23-1
Regler RQ 450 .. A ..			
450/1250	A 812 D	110 181	22-16
450/1275	A 658 D	110 128	22-11
	A 713 D	110 146	22-13

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200/1100	P 196	100 026	25-3
	P 279 D	110 053	26-5
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225/1000	P 98	100 036	25-4
	P 118	100 035	25-3
225/1100	P 115	100 023	25-2
	P 118	100 017	25-2
225/1250	P 115, 207	100 016	25-2
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	P 105	100 014	25-2
Regler RQ 250 .. P ..			
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250/950	P 120 D	110 030	26-3
250/975	P 210 D	110 047	26-4
250/1000	P 26 D	110 008	26-1
	P 39	100 008	25-1
250/1025	P 268 D	110 052	26-5
250/1050	P 42	100 010	25-1
	P 42 D	110 011	26-1
250/1075	P 71 D	110 019	26-2
	P 135 D	110 036	26-3
	P 136 D	110 037	26-3
250/1100	P 6 D, 9 D, 141 D, 641 D	110 004	26-1
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	P 73 D	110 020	26-2
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	P 96 D, 132 D, 179 D	110 027	26-2
	P 111 D, 138 D	110 029	26-3
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250/1150	P 209	100 027	25-3
250/1200	P 252	100 025	21-3

Regler RQ 250 .. P ..		Regelteil Bestellnummer 2 428 ..	siehe VDT-WPP 211/..
250/1250	P 70	100 013	25-2
	P 102	100 012	25-2
250/1300	P 65 D, 250 D	110 016	26-2
250/1400	P 79 D	110 025	26-2
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275/780	P 30 D	110 009	26-1
Regler RQ 300 .. P ..			
300/750	P 105	100 021	25-2
300/900	P 95 D	110 026	26-2
	P 271	100 034	25-3
300/1000	P 40	100 009	25-1
	P 145 D	110 040	26-4
300/1100	P 143 D	110 039	26-3
	P 179 D	110 042	26-4
	P 186 D	110 050	26-4
	P 193 D	110 045	26-4
	P 219 D	110 051	26-4
300/1250	P 187	100 024	25-3
	P 189 D	110 041	26-4
300/1275	P 100 D	110 032	26-3
300/1300	P 65 D	110 035	26-3
	P 134 D	110 044	26-4
	P 174 D	110 049	26-4
Regler RQ 750 .. P ..			
750	P 214	100 028	25-3
Regler RQ 1100 .. P ..			
1100	P 214	100 030	25-3

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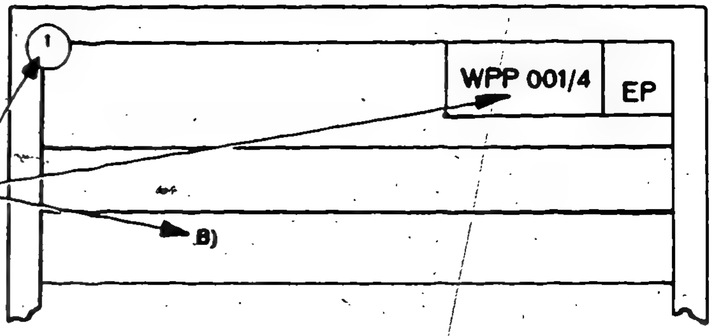
W - 420/1000

Use English cover sheet as shown alongside

Utiliser la feuille-cache ci-contre en langue française

Emplear la hoja cubertera al lado en español



Bis VDT-WPP 211/2-120 sind die Prüfwerte nach PRG .. Z Bezeichnung aufgeführt, ab VDT-WPP 211/21-1 nach Bestellnummer.

Änderungs- und **Anbaubuchstaben** (z. B.: RQ ../..AA..DR) ändern nichts an der Einstellung und werden nicht besonders aufgeführt.

The test specifications are listed by PRG ... Z designations up to VDT-WPP 211/2-120; from VDT-WPP 211/21-1, by the part numbers.

Letters denoting modification and fitting (e.g.: RQ ../.. AA .. DR) involve no changes in the settings and are not listed separately.

Les valeurs d'essai sont ordonnées suivant la désignation PRG .. Z pour les imprimés jusqu'à VDT-WPP 211/2-120 et suivant la référence à partir de VDT-WPP 211/21-1.

Les lettres indiquant une modification et le montage (p.ex.: RQ ../.. AA .. DR) no changent rien au réglage et ne sont pas particulièrement mentionnées.

Los valores de ensayo están ordenados según la designación PRG ... Z hasta folleto VDT-WPP 211/2-120, a partir de VDT-WPP 211/21-1 según números de pedido.

Letras indicadoras de cambios y de montaje (ej.: RQ ../.. AA . DR) no influyen el reglaje y no se indican especialmente.

PARTICULARLY EXACT TESTING AND SETTING OF GOVERNORS RQU.. ZW 0 422 405 ..., .. 407 ..

In order to understand these instructions better, we recommend that you read them in conjunction with the test specifications for the following fuel-injection pumps with governors:-

Fuel-injection pump PE 8 ZWM 140/120 RS 19
Governor RQU 375/1100 ZW 19 DR or 25 DR

1. General

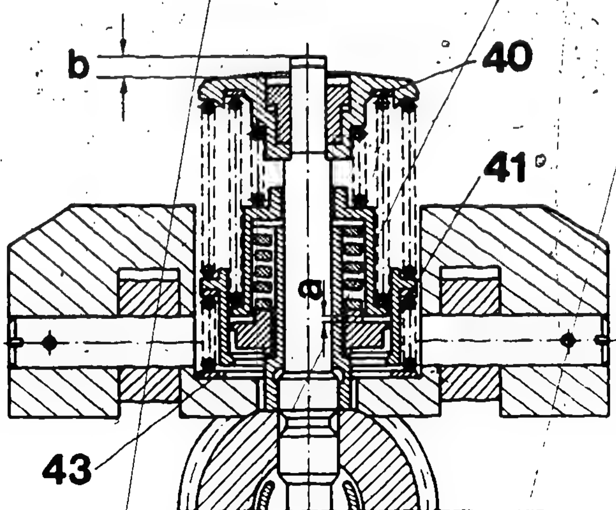
The governors are tested and set according to the test specifications. It is a prerequisite that the flyweight assembly part be fitted and checked with the greatest care. The required fuel-delivery curve cannot be reached with parts which, with regard to torque control and torque-control spring pretension, do not lie within the permissible tolerances.

2. Setting the torque control

With these governors the torque-control spring should lie under a certain pretension when it is compressed. The torque control dimension "a" is set so that the total spring control (torque control) when not tensioned is 0.1 mm longer (e.g. dimension "a" = 0.8 mm + pretension 0.1 mm gives a rated dimension of 0.9 mm). This means that when compressed (pretension pressed together) the prescribed dimension "a" (e.g. 0.8 mm) for the torque control must be available.

3. As a result of tests to make the exact adjustment of the two speeds, various washers have been stipulated for the governor springs (full-load and idle speed regulation). (See service parts list and sketch).

b = approx. 1.8 mm
= 3 notches



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4. When fitting the flyweight assembly part, the governor springs with the ratchet nut must not be tensioned more than 3 notches (distance of front of ratchet nut approx. 1.8 mm from the front of the threaded bolt to the inside).

5. Setting and testing the governor

   The adjustable stop bracket on the top of the governor housing must be fixed in its end position (direction towards the pump).

6. Testing the total control-rod travel

   Example: at a speed of 500 min^{-1} and greatest control-lever deflection (approx. 60-62°) the control-rod travel required in Section B columns 1-3 (framed value) should be reached. If this is not reached, adjust by changing the position of the sliding block. Then push back the control lever 2° (= 58-60°) and test the governor according to the remaining details in columns 2 & 3.

7. Testing the torque curve and the start of full-load speed regulation

   Section B columns 10 and 11 (control-lever position 58-60°). At a speed of 30 min^{-1} the governors should have regulated higher than the upper rated speed by max. 1.0 mm control-rod travel.
   If breakaway demands a correction of the pretension of the governor spring, the springs must not be pretensioned more than 3 notches more. In this case the governors should be adjusted by placing appropriate washers (item 40 in sketch) under the middle spring and by turning back the ratchet nut (but not more than 2 notches).

8. Idle test and adjustment   Section B columns 7-9

   Example: RQU 375/1100 ZW 19 DR or 25 DR: set the control lever at speed given (1st. framed value) 600 min^{-1} and hold until there is a control-rod travel of 2.8 - 3.1 mm.
   The control-lever position here should be approx. 22°; now with the same control-lever position and falling speed, measure the control-rod travels given at 250 min^{-1} and 375 min^{-1} (2nd. framed value).
   If at a speed of 250 min^{-1} the control-rod travel is lower than 11-12.6 mm, then more washers (item 41 in sketch) must be inserted or vice-versa.
   If at a speed of 375 min^{-1} the control-rod travel is lower than 6.2-6.5 mm, then extra washers (item 43 in sketch) must be added or vice-versa. In this case washers of the same thickness may have to be taken out (item 41 in sketch).

With other designs one should proceed accordingly.

The most important measuring points in the example given under 8. are therefore as follows: (however, the details given on the relevant test specification sheet should be observed):

8.1 Set the control lever to 2.8 - 3.1 mm control-rod travel. The lever position here is 22°.

8.2 The control-rod travel of 6.2 - 6.5 mm which is required at 375 min^{-1} can be held exact by adjusting with washers (items 43 and 41).

8.3 Maintaining a certain control-rod travel at a certain speed (e.g. 450 min^{-1}) Maintain the control-rod travel at the lower tolerance limit. In order to keep the control-rod travel within the required speed limits when the former has to be corrected at a later stage, the ratchet nut can also be adjusted by 1 notch, but for each notch adjustment 1 washer (item 40 in sketch) must be added or removed.

9. Adjustment of idle and full-load deliveries according to Section C, 1-7

With the control-lever deflection given in Section B column 7 (e.g. approx. 22°) the idle stop must in each case be set at decreasing speed and the fuel delivery must be measured. See Section C columns 6 and 7 upper values. (After this adjustment the control lever must not be moved any more).

9.1 Full-load delivery and fuel-delivery curve

Adjust the full-load delivery according to Section C columns 1 and 2 and the fuel-delivery curve according to columns 4 and 5.
When adjusting the full-load delivery and measuring the fuel-delivery curve, please see that the governor control-lever lies properly against the side of the full-load stop screw. Under no circumstances may the opposite side of the governor control lever be blocked by the angle measuring device.

9.2 Control-rod travel limitation

Set the control-rod travel limitation at a speed of 100 min^{-1} and with the control lever in full-load position with the stop bracket in the top of the governor housing to 18 mm control-rod travel (Section C, columns 6-7).

9.3 Adjusting the shutoff solenoid

The solenoid must be set so that it stops 0.5 - 1.0 mm before the STOP position with a 24 V battery circuit.

9.4 Setting the STOP screw

Set the stop screw so that when the idle stop is exceeded, 0.5 mm control-rod travel is reached.

9.5 The oil-block filter including the fuel lines, must be tested for leakage of the housing and the connections with compressed air at 1 bar in an oil bath (from the flange side).
The oil-inlet valve 1 417 413 101 must also be tested for leakage with an oil pressure of 5 bar. Closing pressure at least 3 bar.
In addition to this, the complete pump assembly must be tested for leakage at the end of the test (pressure 0.5 - 1 bar).

0 422 . . – RQU(V) . . Z . . Governors

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New ball bearing during repair work

VDT-I-422/100 B
4. 1977
Destroy edition of 4. 1975!

The ball bearing 1 900 900 027 used up till now in these governors can no longer be supplied. Ball bearing 1 900 900 204 will be supplied by way of replacement.

In a case where new ball bearing . . 204 is to be fitted, the parts

item 22/1	link
item 22/36	plain washer, and
item 23	bearing end plate

must be replaced too.

Please take the part numbers from the appropriate service-part microfiche.

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L1

NEW LINK WITH TOOTHED GEAR

0 422 ... ... RQU (V) ... Z... Governor

VDT-I-422/101 En
2.1981

From date of manufacture 924 (4.79) single-part links (driver) item 22/1 in the Service Parts List, have been used with the above mentioned governors. The closing cover (item 18) 1 420 551 020 is thereby replaced by the gasket 2 420 526 010. The guide pin (item 19) 1 423 104 000 and the helical compression spring (item 20) 1 424 611 011 are no longer required.

When repair work is carried out only the single-part link should be used. See microfiche for the part number. If in the case of governors with date of manufacture before 924, the link is not replaced by the single-part link, then the item nos. 18, 19 and 20 in the Service Parts List remain valid.

Flyweight assembly	Item	Old link	New link	Toothed gear
2 428 152 006,...143 010, ...143 013,...014,...029	22/1	2 422 125 017	2 426 325 018	Pos. 22/31 1 426 317 012 no longer applies
2 428 142 009,...010, ...012,...013,...014, ...015, 2 428 143 011, ...031	22/1	2 422 125 017	2 426 325 019	Pos. 22/31 1 426 317 014 no longer applies
2 428 142 011, ...143 012,...015, ...016,...020,...022, ...026	22/1	2 422 125 017	2 426 325 020	Pos. 22/31 1 426 317 010 no longer applies
2 428 152 008,...009, ...012,...013,...014	22/1	2 422 125 018	2 426 325 021	Pos. 22/31 1 426 317 014 no longer applies

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Flyweight assembly	Item	Old link	New link	Toothed gear
2 428 152 010	22/1	2 422 125 020	2 426 325 022	Pos. 22/31 2 426 317 024 no longer applies
2 428 143 019,...021, ...023,...024,...033	22/1	2 422 125 022 or 024	2 426 325 023	Pos. 22/31 1 426 317 010 no longer applies
2 428 143 028,...030, ...032,...034,...035, ...036,...037,...038 and 2 429 992 750	22/1	2 422 125 024	2 426 325 024	Pos. 22/31 2 426 317 024 no longer applies
2 428 143 018	22/1	2 422 125 017	2 426 325 025	Pos. 22/31 1 426 317 011 no longer applies

The new link differs from the old one by the shrunk on toothed gear.
When repair work is carried out governors with date of manufacture up to 924 should be converted to the new design.

NEW LOCKING METHOD FOR THE EDGE CAM AND LOCATING PINS IN THE GOVERNOR COVER

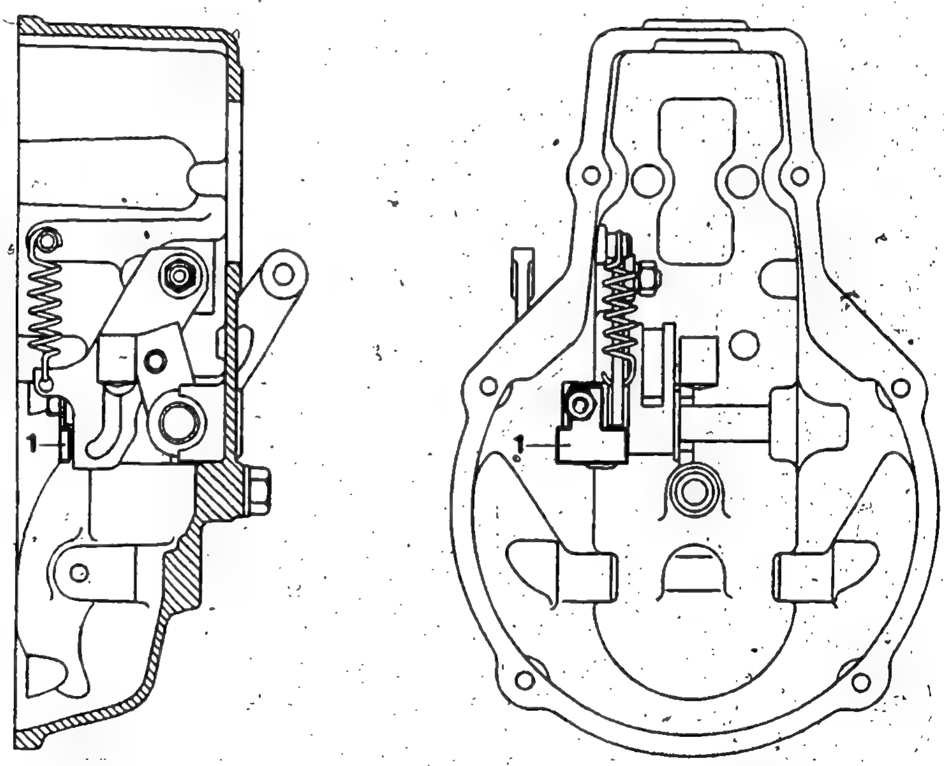
with 0 420 2.. - RQV..A..(K)
0 421 8.. - RQV..P..(K)
0 420 08.. - RQV..MW..

With the above mentioned mechanical governors the edge cam and the locating pins may have become loose or fallen out.

The locking method has been changed.

When repair work is carried out on these governors, the new tab washers must be used.

2 421 321 008 for RQV.. (K) governors or
2 421 321 009 for RQV.. governors



1 = tab washer

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BOSCH

TEST INSTRUCTIONS
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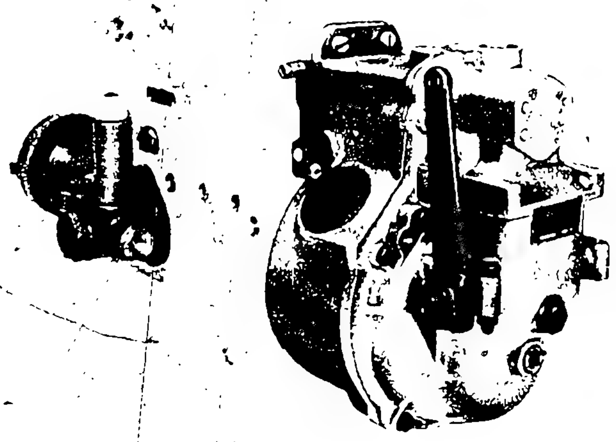
VDT-WPP 001/4 B Suppl. 6
Ed. 1



Mechanical Governors

0 420 21 . . - RQV . . A . .
0 420 81 . . - RQV . . P . .

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1. Introduction

This booklet contains instructions for testing the RQV governor in both its basic design as well as in its well-known variants.

These instructions refer to the governors associated with pump sizes "A" and "P" with a housing OD of 149 mm, and they describe basically the correct adjustments of the governor springs, the sliding sleeve position, the "S" plate, the control rod travel, and the advance angle.

In addition, instructions relating to the full-load adjustment are contained in this booklet. The various types of stops are described in a special section in detail. Initially, however, they have been listed on the applicable Test Specification Sheet VDT-WPP 001/4.

The Test Instructions issued previously, VDT-WPP 001/4 B, continue to apply to the rarer governors with housing dia. of 143 or 167 mm, i.e., mainly pumps of size "B".

1.1.
Testing and checking tools shown in this booklet:

Control rod travel measuring device for P-pumps	1 688 130 030	EFEP 393
Dial indicator, 30 mm travel, graduated in 1/10 mm	1 687 233 015	EFAW 144
Measuring device – to measure sliding sleeve position	1 682 329 038	EFER 618
Universal control rod travel measuring device	1 688 130 095	EFEP 565
Extension coupling, cone of 25 mm dia. for pumps with manifold pressure compensator	1 686 430 007	EFKH 1Y 13Z
Setting device for measuring the control rod travel on the governor side	1 688 130 079	EFEP 541
Setting device for control lever position	0 681 440 006	EFEP 56 C
Control rod travel measuring device	0 681 440 009	EFEP 171

When making adjustments on pumps with camshafts with cone dia. of 17 and 20 mm, it is advantageous to use extension couplings so that the corresponding control rod travel measuring device can be attached:

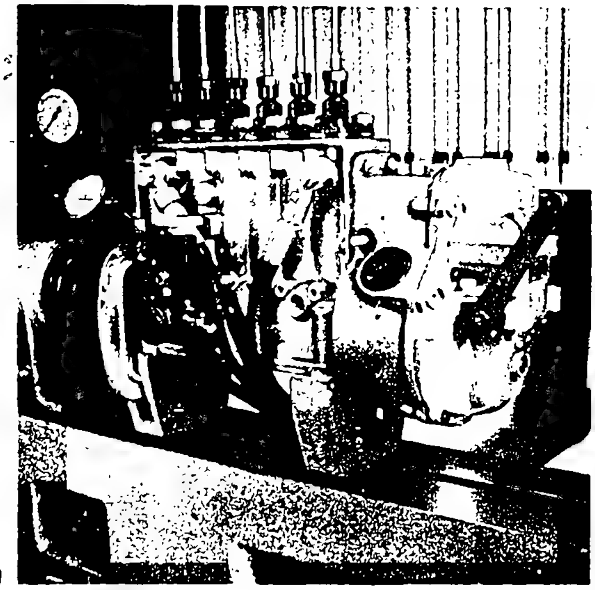
Extension coupling, for cone of 17 mm dia.	1 416 430 012	ZKH 74Z 9X
Extension coupling, for cone of 20 mm dia.	1 416 430 017	ZKH 74Z 18X
Loctite CVV, Iden. No. 82	commercially available	see Section 3.3.

L6

WPP 00114, N6

1.2. Clamping the Pump

Connect the lines and attach the control rod travel measuring device.
Remove the governor cover.



1

2. Preliminary Adjustments

Remove the sliding block and the adjusting pin by taking out the coupling bolt.

2.1.
Check the play of the adjusting pin.

Set the longitudinal play of the adjusting pin (0 mm) by turning the castle nut.

2

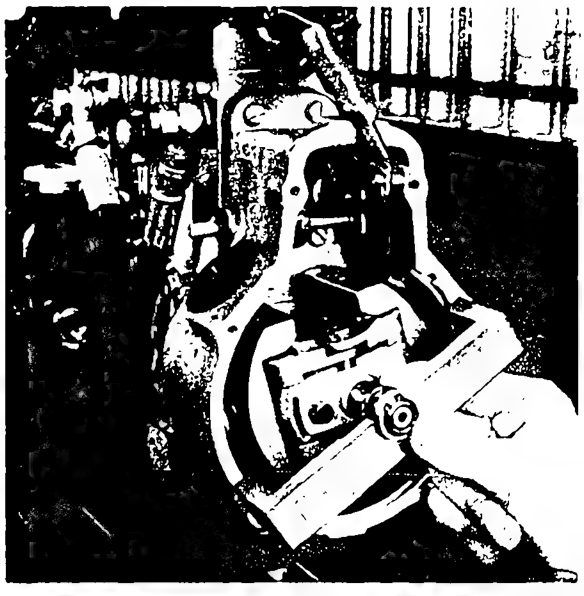
2.2.
Measure the position of the sliding block:

The rated distance from the center of the sliding block to the housing support (without seal) is 34.9 ± 0.2 mm.

Position the adjusting pin by means of the coupling bolt in the flyweight assembly.

Pull on the adjusting pin so that the flyweights are drawn inward; (do not apply too much pressure to the adjusting pin spring).

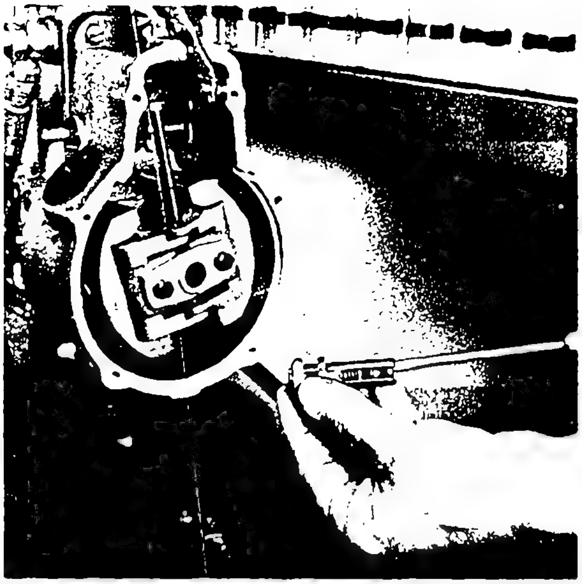
In this position, the measuring device 1 682 329 038 should fit snugly, i.e., with no play, into the sliding block guide.



3

L7

X25



5

2.3.
Set the adjusting pin:

Remove the adjusting pin; change the length of the adjusting pin by turning the adjusting screw until the rated distance according to Section 2.2. is reached.

The adjusting pin and the sliding block together constitute the sliding sleeve.

4

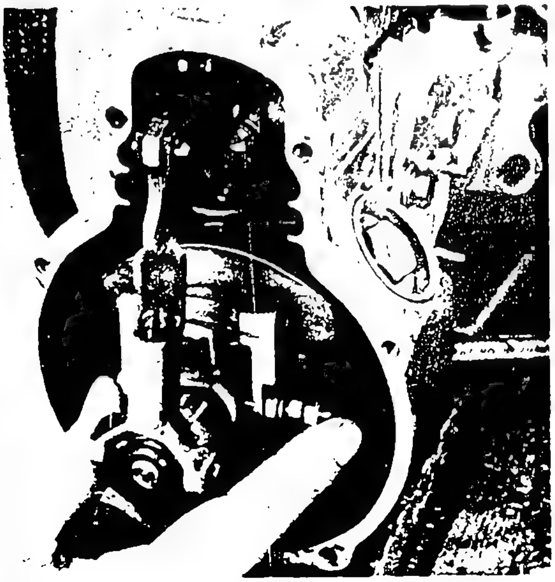
Abnormal position of the sliding sleeve according to the Test Sheet:

Correct any difference from the rated distance by turning the adjusting screw on the adjusting pin:

Example:

Rated distance (in mm)	34.9
Changed distance (based on Test Sheet)	36.0
Difference	1.1
Lead	0.75

therefore, the adjusting screw should be turned outward 1 1/2 turns.



6

2.4.
Mount the fulcrum lever, sliding block, adjusting pin, and coupling bolt.

Longitudinal play of the coupling bolt: 1 - 2 mm.

2.5.
Check the position of the "S" plate:

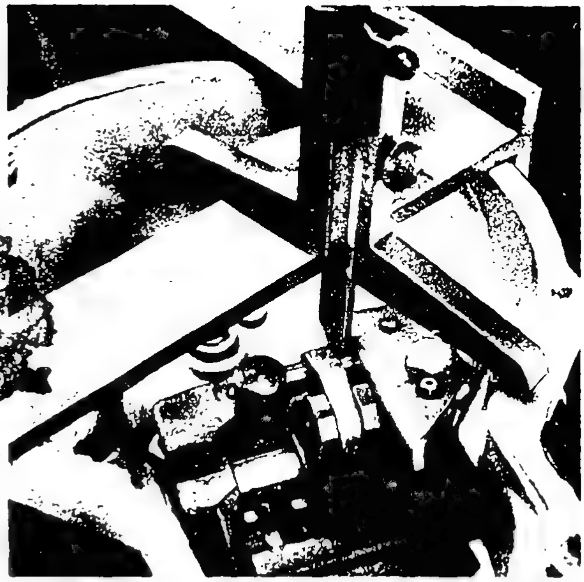
Turn the control lever over so that contact is not made with the stop screw.

The rated distance from the seal on the cover to the center of the pilot = **24.5 mm.**

Set the control lever to maximum fuel. The pilot pin on the linkage lever is located at the end of the "S" track.

Place the seal and the gage in the proper position.

Example:
A pilot of 6 mm dia. and a 6-mm gage give the distance of 27.5 mm measured from the gage to the pilot (that is, 27.5 minus the thickness of the gage **plus** 1/2 the diameter of the pin).
Set the distance with washers under the "S" plate.

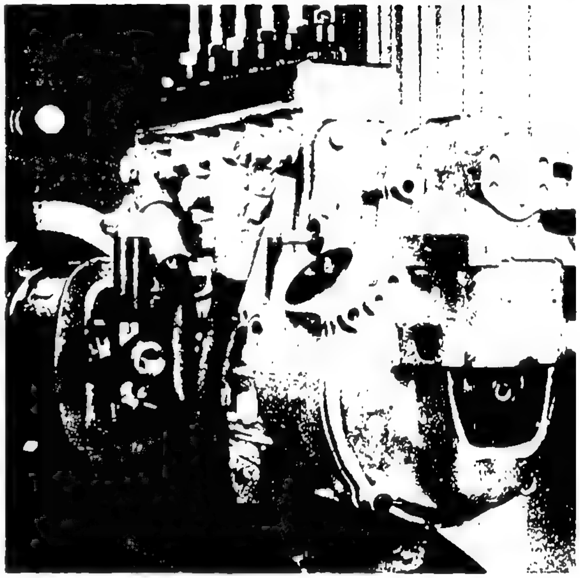

7

3. Adjustments

In order to prevent the elements from running dry, clamp the control rod at a control rod travel (RW) of about 9 mm.

As protection, mount a temporary cover with a section cut out for the adjustment.

Pour in lubricating oil.


8

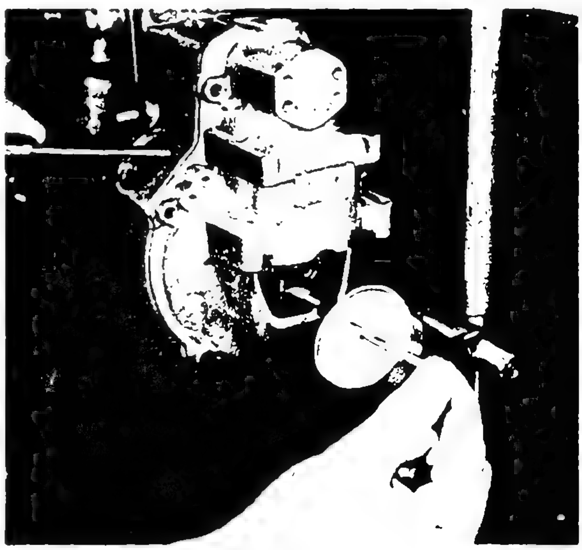
3.1.
Measure the sliding sleeve travel:

The sliding sleeve travel, as indicated in the Test Sheet, can be measured with the universal control rod measuring device 1 688 130 095.

The magnetic base of the dial indicator is positioned against the sliding block.

At zero rev/min, pre-stress the dial indicator about 20 mm; compensate for play in the governor mechanism by a light pull on the dial indicator spindle.

Set the dial indicator to "0".


9

3.2.
Tension the governor springs – 3 methods:

3.2.1.
Set the sliding sleeve travel according to Test Sheet VDT-WPP 001/4.
At the speed specified, tighten the governor springs on both sides uniformly (a difference of one notch is permissible) until the associated sliding sleeve travel (± 0.2 mm) is reached (Columns 10 and 11). Tightening the springs results in a shorter sliding sleeve travel – try to set the travel at the upper tolerance. The total travel should be at least 11 mm.
If this value cannot be reached, replace governor parts. Observe instructions given in the Test Sheet and in the Service Parts List (washers and spring seats as required).

① **PRÜFWERTE 40**

VDT-WPP 001/4 ..

Abschnitt B .. Ausgabe

7	8	9	10	11
Untere Nenndrehzahl			Muffenweg ~~Angleichung~~	
Verstell-hebel-ausschlag Grad	U/min	Regelweg mm	U/min	MW mm ~~RW mm~~
ca. 10	100	6,6 - 8,0	0 - 70	Beginn
	250	5,0 - 6,6	200	0,6 - 1,2
	400	2,9 - 4,6	480	5,2 - 4,0
	550	1,2 - 2,6	800	4,8 - 5,2
	700	0	1270	8,3
			1420	Ende (11)
			1510	

10

3.2.2.
Set the sliding sleeve travel based on General Test Specifications.
If sliding sleeve travel data is not given on Test Sheet VDT-WPP 001/4, data given under General Test Specifications apply.
Set the speed according to Test Sheet VDT-WPP 211/3.
Tighten the springs on both sides uniformly (a difference of one notch is permissible) until the prescribed sliding sleeve travel is reached.

PRÜFWERTE 40

VDT-WPP 211/3- ..

.. Ausgabe

7	8	9	10	11
Untere Nenndrehzahl			Muffenweg ~~Angleichung~~	
Verstell-hebel-ausschlag Grad	U/min	Regelweg mm	U/min	MW mm ~~RW mm~~
ca. 10	100	6,6 - 8,0	1150	8,3
	200	5,2 - 7,4		
	400	3,7 - 4,0	–	–
	600	2,5 - 4,0		
	760	0		

11

3.2.3.
Adjustment when the sliding sleeve travel is not known:

At a speed based on Test Sheet VDT-WPP 001/4, Section B, Column 2, top line, the sliding sleeve travel should be 8.1 – 8.5 mm.
Tightening the governor springs results in a shorter sliding sleeve travel.
Total sliding sleeve travel: at least 11 mm.
In order to reach the prescribed values at the upper rated speed, the initial compression of spring set in this method according to Section 4.3.1. must be corrected again (one notch difference is permissible).
The tightening nuts must be set so that they are between a flush fit and a position in which the threaded pin projects out a distance of 3 mm!

B) Einstellwerte des Reglers

1	2	3	4	5
Obere Nenndrehzahl			Mittlere Nenn	
Verstell-hebel ausschlag Grad	U/min	Regelweg mm	Verstell-hebel-ausschlag Grad	U/min
ca. 68	1150	15,0 - 18,2		–
	1380	0 - 1,5		
ca. 62	1100	15,0 - 17,8		
	1150	10,2 - 13,8		
	1200	5,0 - 10,0		
	1250	0 - 5,6		
	1320	0		

Angleichweg Maß a = — mm

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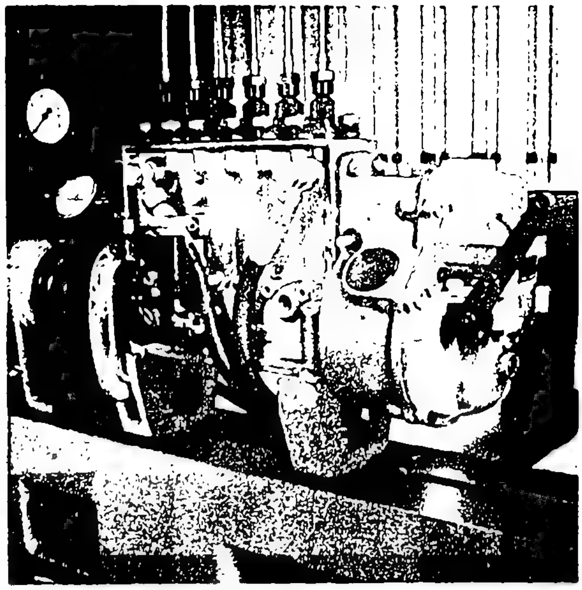
3.3.
Mount governor cover:

Release the clamping screw at the control rod travel measuring device.

When the control rod is positioned against the mechanical shut-off stop, set the dial indicator to "0".

Replace the governor cover with the seal and slide the guide block into the guide sleeve with the longer part pointing upward.

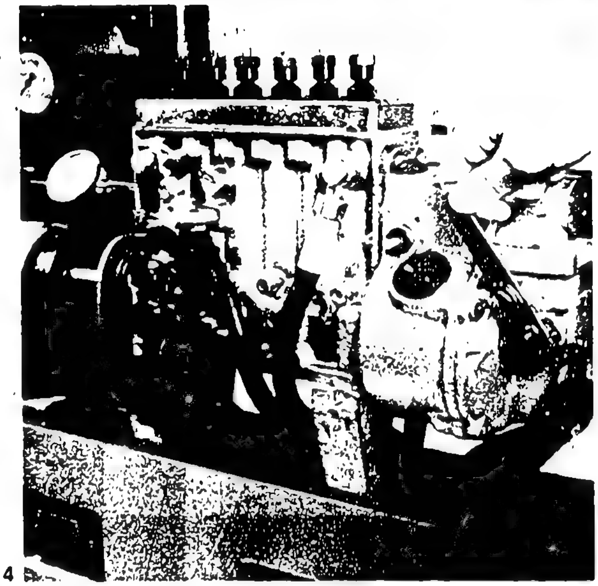
Seal the sliding block guide pin with Loctite.



13

3.4.
Check the sliding sleeve position and the "S" plate:

With the control lever at full deflection – at a speed set according to the Test Sheet, Column 2, upper line – the associated control rod travel must be attained.



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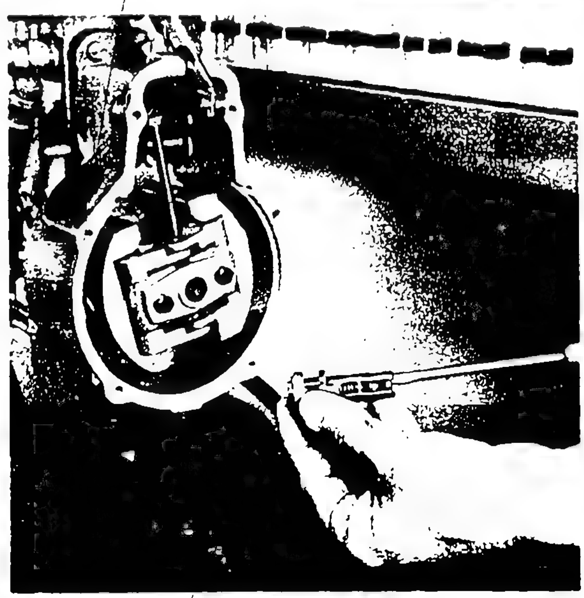
Correct for larger deviations at the adjusting pin and for deviations up to 1 mm at the "S" plate:

1/2 turn of the adjusting pin = about 2.25 mm of control rod travel;

0.15 mm washers at the "S" plate = about 1 mm of control rod travel.

A shorter adjusting pin or fewer washers result in a shorter control rod travel.



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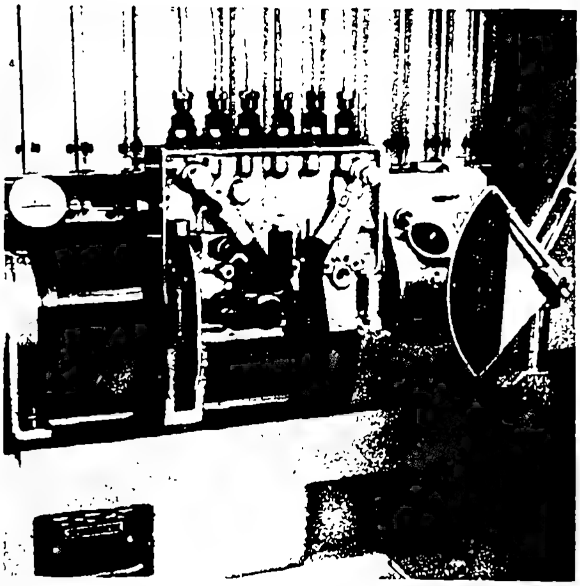
4. Checking the Governor

4.1.
Attach the setting device for the control lever position.

Move the control lever slowly from shut-off toward the maximum fuel direction – the control lever is positioned at 0 degrees when the control rod travel dial indicator just leaves the zero mark.
Set the gage to the zero position determined.



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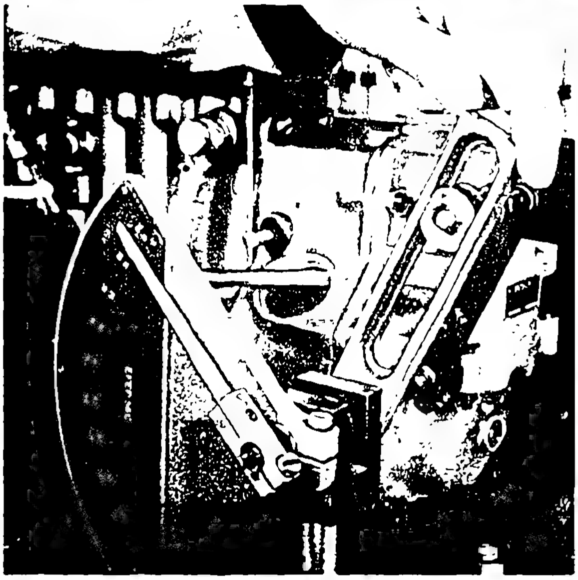
4.2.
Check the play in the transmission parts:

At zero rev/min set the control rod travel to 2 mm with the control lever and clamp the control rod in place. Using a screwdriver inserted through the opened housing port, press the flyweights into the inside position and move the control lever. The play measured in this way should be no more than 5 degrees.

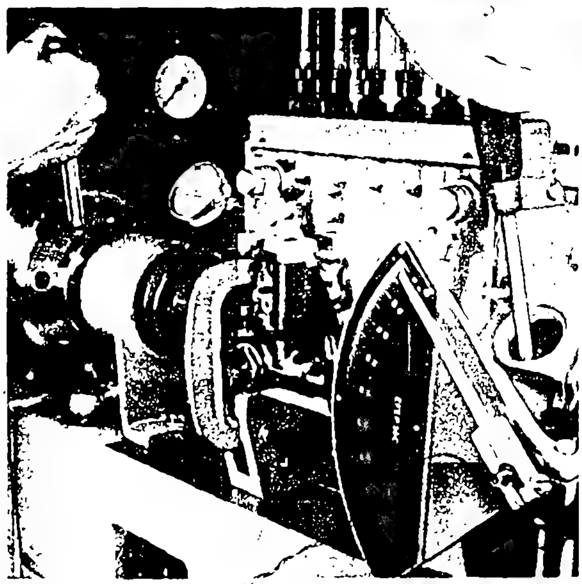
If necessary, replace the flyweight assembly.



17

Again using the screwdriver, block the flyweights from turning. Turn the flywheel on the test bench in both directions. The play measured here may be 10 - 25 degrees.

If necessary, replace the rubber buffer.



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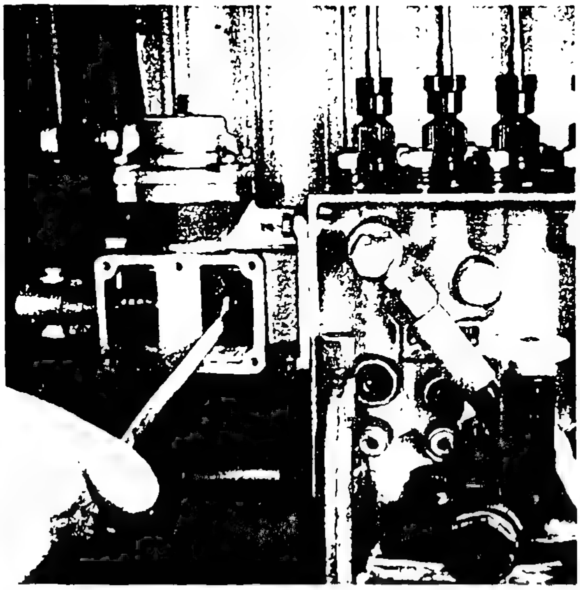
U12 L2



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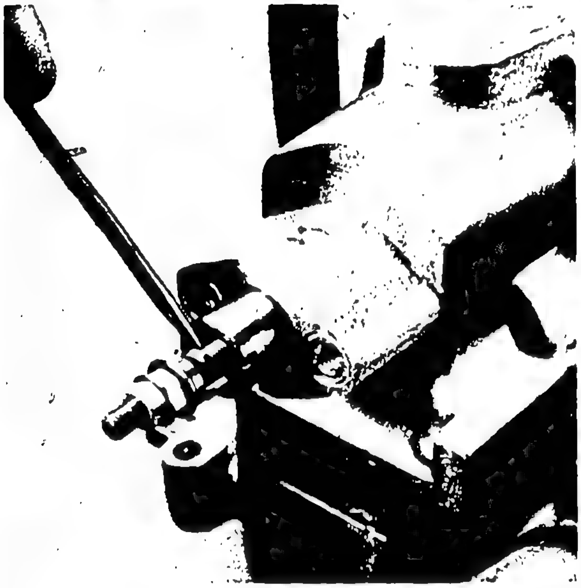
5. Adjustments Based on Section C of Test Sheet

5.1.
Full-load delivery – Columns 1 and 2.

Attach the stop and set it according to the Test Sheet. Also see VDT-WPP 115/1 B, Page 12.

5.2.
Set the change-over point of the automatic starting fuel delivery.
If no "Change-over Point" is given on the Test Sheet, a speed of 50 – 100 rev/min under "Lower Rated Speed" applies.



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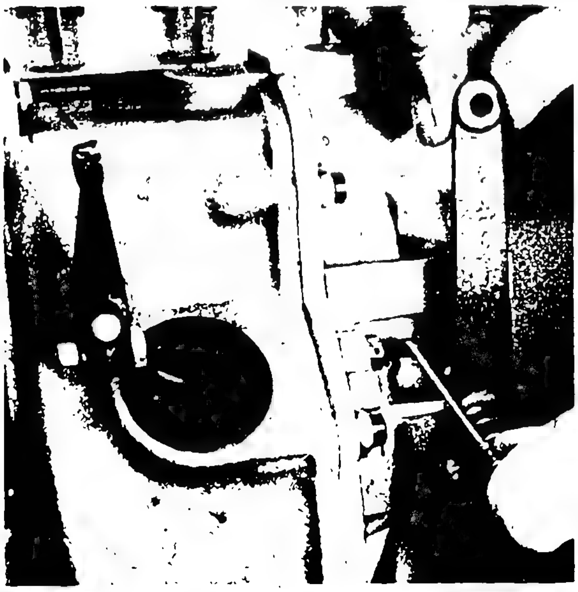
5.3.
Torque control and fuel delivery characteristics.

Section B, Columns 10 and 11.
Section C, Columns 4 and 5.

The adjustment depends on the associated full-load stop.

Tighten the torque control spring until the prescribed fuel delivery characteristics are attained.



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5.4.
Speed limitation – Section C, Column 3.

Turn the control lever over and set the adjustable stop screw so that at the prescribed speed the control rod is drawn about 0.5 mm out from the full-load position.

Even if the values on the Test Sheet are different, the same procedure is still to be followed.

WPP00114, N6

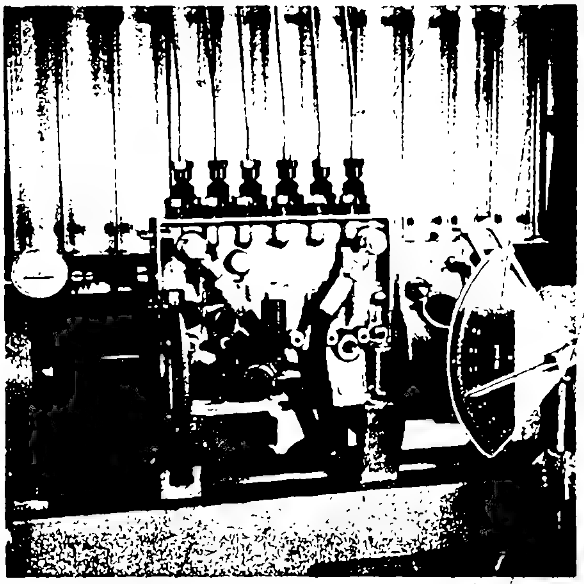
4.3.
Check speed regulation:

4.3.1.
Upper rated speed – Columns 1 to 3.

At the speed given in the top line, shift the control lever until the prescribed control rod travel is reached.

Read the scale – all "approx." readings mean ± 3°, and when checking they are ± 4°.

Check the speed regulation with increasing and decreasing speeds – up to about 1100 rev/min the control rod travel difference may not be more than 1 mm, and it may not be more than 2 mm above this speed.



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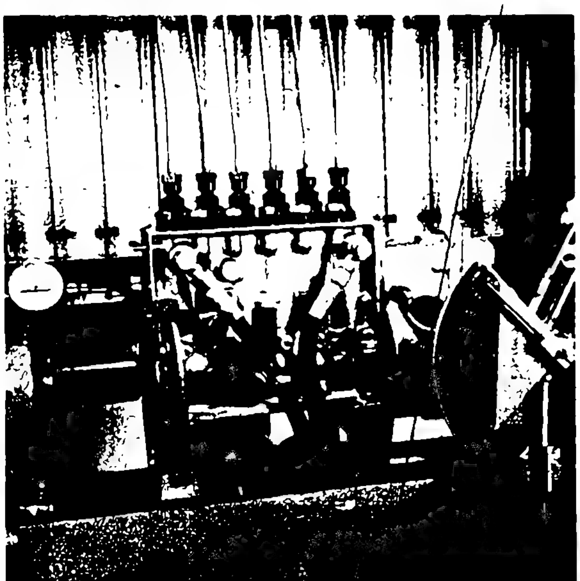
4.3.2.
Lower rated speed – Columns 7 to 9.

Bring the control lever back until the control rod travel given is reached at the associated speeds.

Check the speed regulation with increasing and decreasing speeds – the difference may not be more than 1 mm of control rod travel.

(Correct deviations by replacing the "S" plate, spring seat, shims, and possibly the idle springs as well as the play-compensating spring!)



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4.3.3.
Average Rated Speed – Columns 4 to 6 – if given.
Change the position of the control lever until the values are reached.

① B) Einstellwerte des Reglers

RQV .. 150D, 166

1	2	3	4	5	6	7	8	9	10	11
Obere Nenndrehzahl			Mittlere Nenndrehzahl			Untere Nenndrehzahl			Angleichung	
Verstellhebelausschlag Grad	U/min	Regelweg mm	Verstellhebelausschlag Grad	U/min	Regelweg mm	Verstellhebelausschlag Grad	U/min	Regelweg mm	U/min	Regelweg mm
ca. 68	1100	14,0 - 16,0	ca. 62	700	14,5 - 17,0	ca. 12	150	6,4 - 8,0	1100	0
	1150	7,0 - 12,4		800	6,8 - 9,6		250	3,7 - 6,0	800	0,3 - 0,5
	1200	0 - 7,2		900	0,6 - 1,0		350	0,7 - 1,9		
	1270	0		1100	0,6 - 1,0		500	0	550	0,5 - 0,7
				1150	0				(nur bei 150D)	

Fig. 21

Angleichweg Maß a = 0,6 mm (nur bei 150D)

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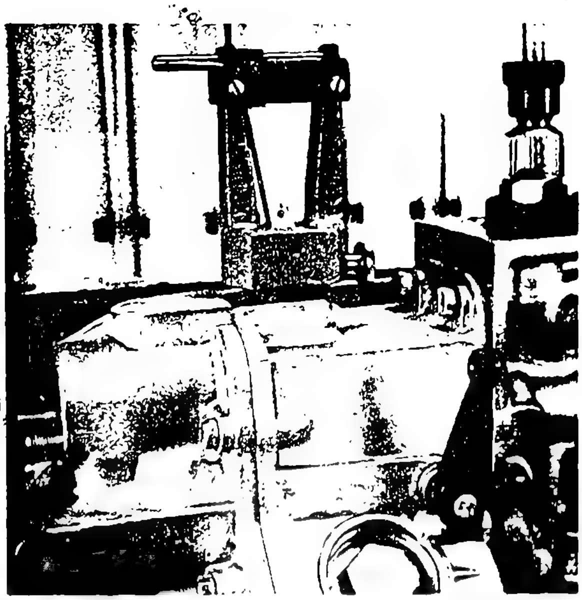
The proper control rod travel measuring device depends on the type of stop used.

An example is shown in Fig. 25: the pump here has the stop on the pump side, so control rod travel measuring device 1 688 130 079 is used on the governor housing.


25

5.5.
Set the shut-off stop screw:

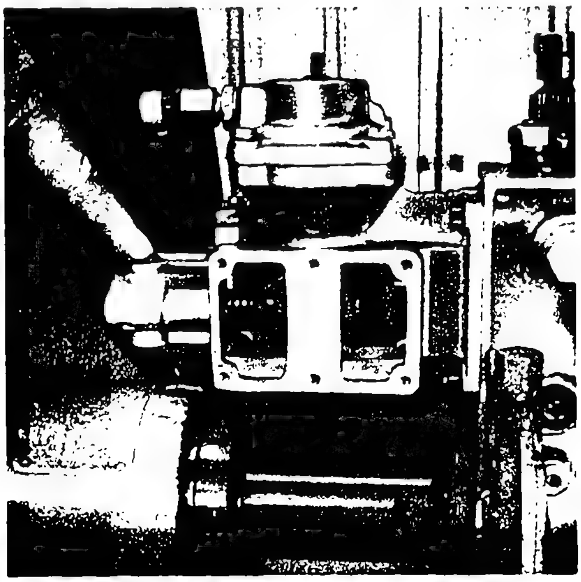
At 0 rev/min set the shut-off stop screw on the control lever to give a control rod travel of 0.5 – 1.00 mm.

Attach the stop lever if provided.

26

5.6.
Measure the starting fuel delivery or starting travel:

Operate the excess fuel starting device – depending on the various stops – and set it properly.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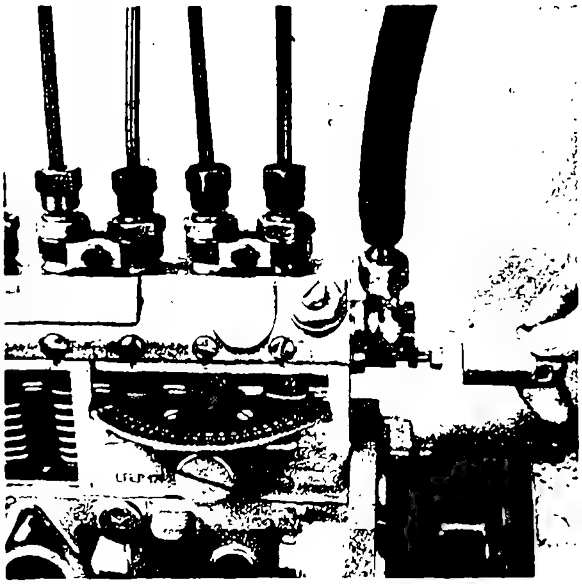

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Example,shown in Fig. 28:
Automatic starting fuel delivery –
starting travel limitation.

6. Sealing

Seal the adjustments made.

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After-sales Service Instructions

Testing

42

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Ed. 2

supersedes VDT-WPP 001/4 B, suppl. 3

Mechanical Governor

0 42 . . – RQV . . K . .

BOSCH After-sales Service Automotive Equipment

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Contents

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2 Tools
3 Preadjustment
4 Governor Testing
5 MPC Adjustment
8 Full-Load Adjustment
14 Schematic Drawings with parts identified by the numbers given in the text
17 RQV . . K . . with MPC on Drive Side

Tools Used (also see WA-VKF 053/1)

Control-rod adjustment mechanism	1 688 130 030
Bracket for measuring the position of the sliding block	1 682 329 038
Control-rod adjustment mechanism for measuring the sleeve travel	1 688 130 095
Protractor for testing the governor	0 681 440 006
Equipment for MPC testing, consisting of: Adjustment throttle	1 688 130 032
Pressure regulator valve for compressed air with pressure gauge 0–4 bar (for example, produced by Kraiss & Friz, Stuttgart, No. 104)	commercially available
Pressure gauge 0–1.6 bar, quality grade 1.0, scale graduations 0.05 (for example, produced by Wika, No. 4184)	commercially available

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(4. 76)

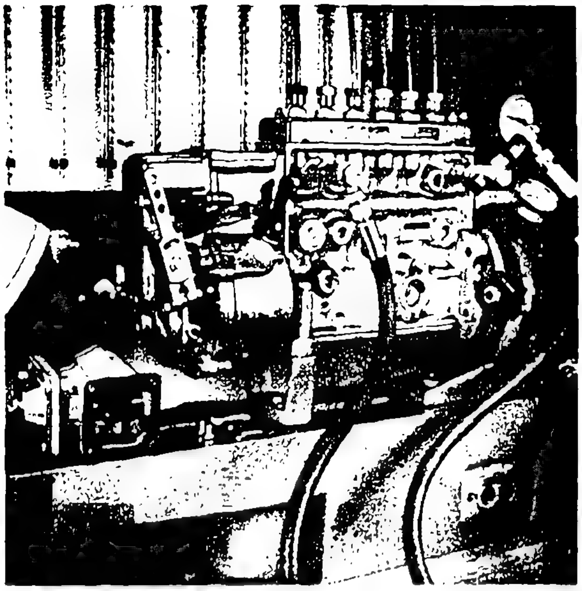
Preparations

Clamp the pump on the test bench, connect lines.

Mount the control-rod travel measuring device.

Remove the full-load stop rocker guide (2) and possibly the manifold-pressure compensator (MPC) if the governor is fitted with this part.

Remove the guide pin for the swivelling lever.



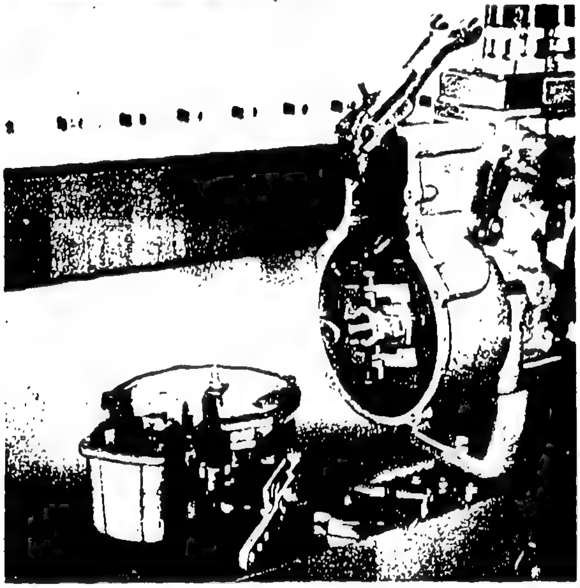
1

Remove the governor cover.

Remove the swivelling lever.

Remove the coupling bolt, sliding block, and adjusting pin.

Position the adjusting pin by means of the coupling bolt in the flyweight assembly.



2

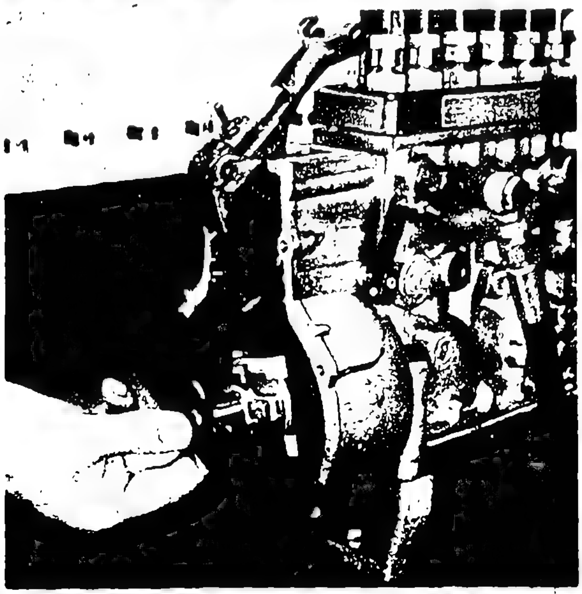
Measure the position of the sliding block
(Use bracket 1 682 329 038.)

The nominal distance from the center of the sliding block to the housing **(without seal)** is 35.0 ± 0.2 mm.

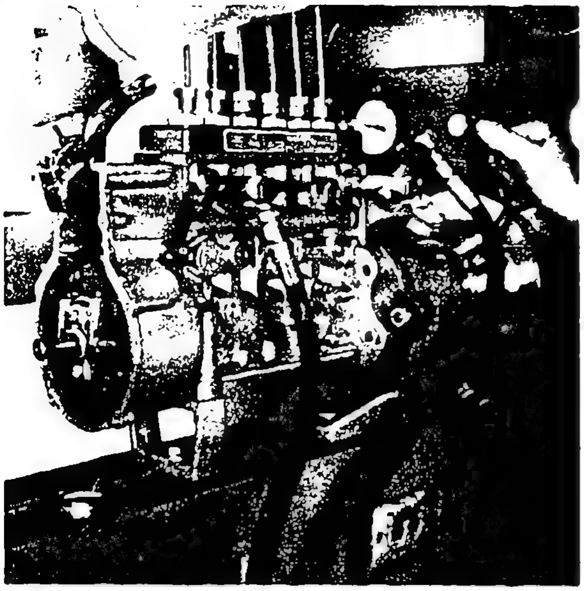
Pull on the adjusting pin so that the flyweights are drawn into the inner position.

In this position (without seal) the measurement device should fit snugly, i. e., with no play, into the sliding-block guide.

If necessary, change the length of the adjusting pin by turning the adjustment screw.



3



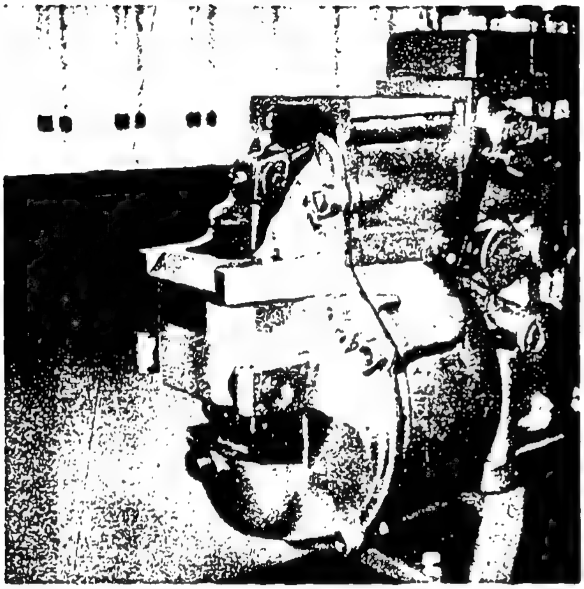
4

Check the play of the rubber buffers

Prevent the flyweights from turning by blocking them with a screwdriver and turn the test bench flywheel in both directions.

The play measured when this is done should be 10–25°.

If necessary, replace the rubber buffers.



5

Prepare the governor for measurement of the sleeve travel

Mount the fulcrum lever, sliding block, and adjusting pin.

The longitudinal play of the coupling bolt should be 1–2 mm.

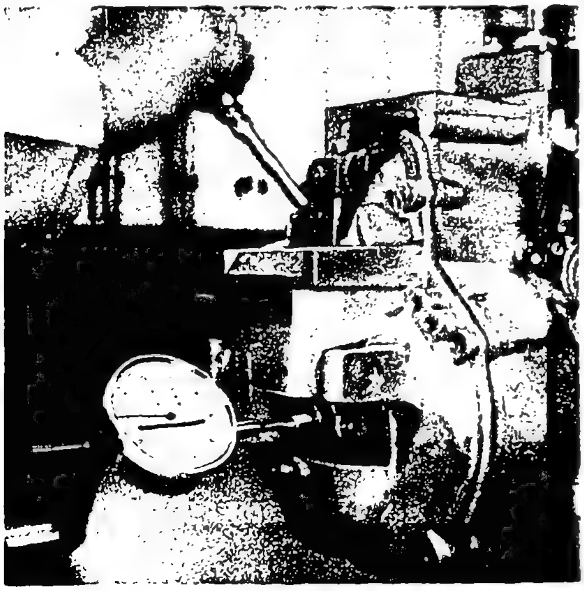
Do not mount the swivelling lever.

In order to prevent the plunger and barrel assemblies from running dry, clamp the control rod at a control rod travel of about 9 mm.

As protection, mount a temporary cover with a section that has been cut out (for example, RQ . . or RQV . .).

For stabilization purposes, the sliding-block guide screw is located under the sliding block.

Fill the governor with lubricating oil.



6

Measure the sleeve travel

The sleeve travel is measured using an instrument stand and a control-rod travel dial indicator.

The magnetic foot of the dial indicator is positioned against the center of the adjusting pin.

Press the governor springs over by hand (flyweights in inner position).

Prestress the dial indicator about 20 mm.

Compensate for play in the governor mechanism by a light pull on the dial indicator stem, and set the dial indicator to 0.

4

Set the sleeve travel according to Test-Specification Sheet B, Columns 10 and 11

The most accurate possible maintenance of the specified sleeve travel is of vital importance for all later measurements!

Set the speed to the value given by the test specification sheet at which the sleeve travel is without tolerances.

Set the associated sleeve travel by uniformly tightening both sets of governor springs.

One notch difference is permissible.

Test the remaining sleeve travel values and if necessary correct them by inserting shims, by the selection of different spring seats, or by replacing the governor springs according to the service part microfiche.

Remove the instrument stand.

Remove the temporary governor cover and collect the lubricating oil.

① **Test Specifications** **40**

VDT-WPP 001/4 .. ..

Section B **.. Edition**

Lower rated speed			Sliding sleeve travel / Torque-control travel	
Degree of deflection of control lever	rev/min	Control rod travel mm	rev/min	mm
7	8	9	10	11
approx.10	100	6,6 - 8,0	0-70	Start
	250	5,0 - 6,6	200	0,5 - 1,2
	400	2,9 - 4,6	480	5,2 - 4,0
	550	1,2 - 2,6	800	4,8 - 5,2
	700	0	1270	8,3
			1420	Finish (11)
			1510	

7

Measure the position of the plate cam

Turn the control lever over so that the stop screw is not up against it.

The nominal distance from the seal on the cover to the center of the pilot = **24.5 mm.**

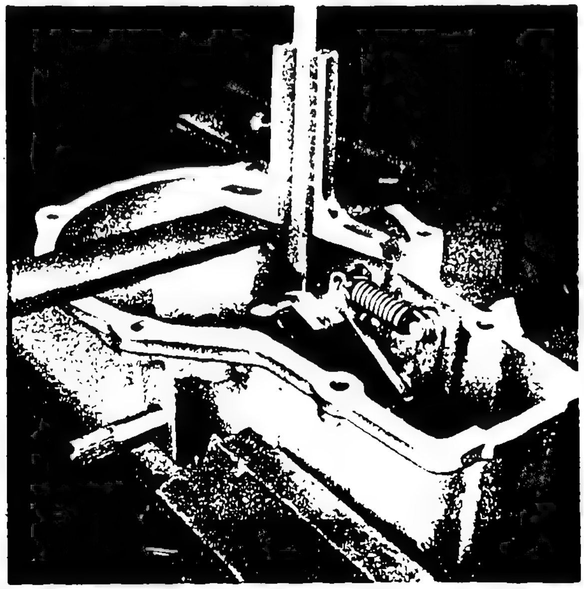
Set the control lever to "Voll" (maximum fuel).

The pilot on the linkage lever is positioned at the end of the rocker guide.

Set the nominal distance by placing shims under the plate-cam stop.

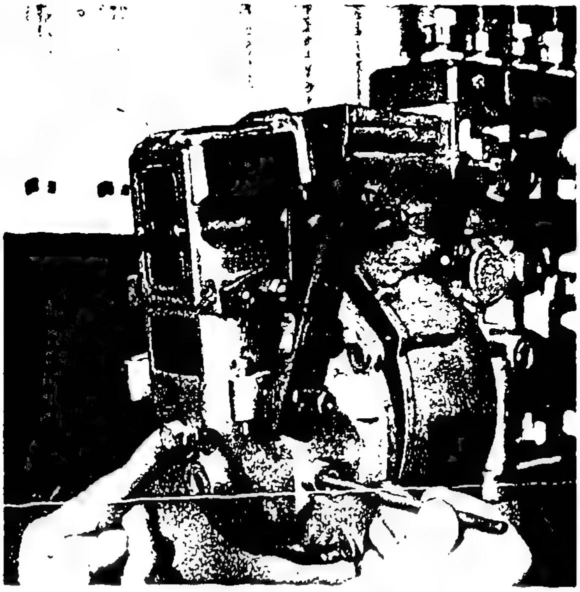
Example of measurement:
With a **pilot 6 mm** in diameter, and with a **gauge 6 mm** thick, the **adjustment distance** is **27.5 mm** from the gauge to the pilot.

This distance is derived as follows:
standard distance (24.5) plus thickness of gauge (6) minus ½ pilot diameter (3) = the adjustment distance of 27.5 mm.



8

L21



9

Fitting the governor cover

Release the clamping mechanism at the control-rod travel measuring device.

Fit the swivelling lever in place.

Fit the governor cover together with a seal **but do not bolt it in place.**
The longer part of the guide block points upward.

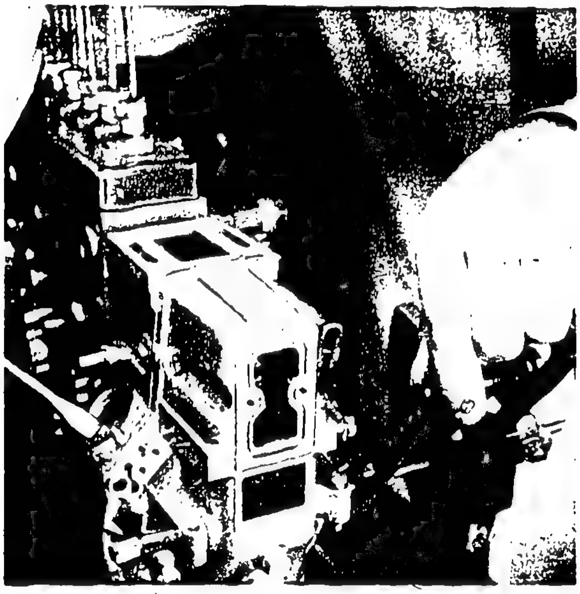
Align the holes in the swivelling lever with the holes in the governor cover using a pointed instrument (for example a marking tool) and insert the guide pin into the governor.

Fit the screw plugs for the guide pin.

Bolt the governor cover in place.

Fill the governor with lubricating oil.

Attach the protractor.



10

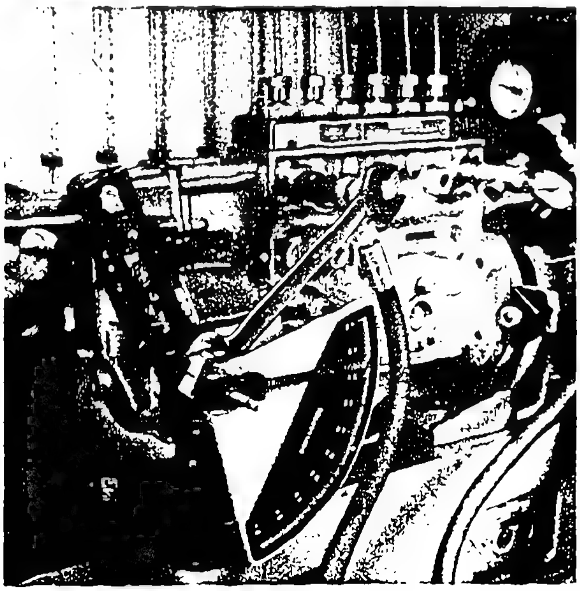
Checking the play in the governor parts

Using the control lever, set the control-rod travel to 2 mm and clamp the control rod in place.

Press the governor springs over by hand.

The control lever play must not exceed 2°.
When carrying out these steps do not press the sprung strap over.

Release the control-rod travel measuring device.



11

Setting the fine adjustment

Set the speed to about 100 rev/min.

Using the control lever, set the control-rod travel to about 10 mm and clamp the control lever.

Release the lock nut for fine adjustment (4) and unscrew the adjustment screw as far as the stop.

Caution:
when reading the control-rod travel values do not press on the adjustment screw!

Set the dial indicator to 0.

Turn the adjustment screw for fine adjustment 1/2 turn inward and observe the dial indicator.

When turning the adjustment screw no longer results in a change in the control-rod travel, the total fine adjustment range can be read on the dial indicator.

Turn the adjustment screw back 1/2 of the fine adjustment range read from the dial indicator and lock it in this position.

Setting the protractor

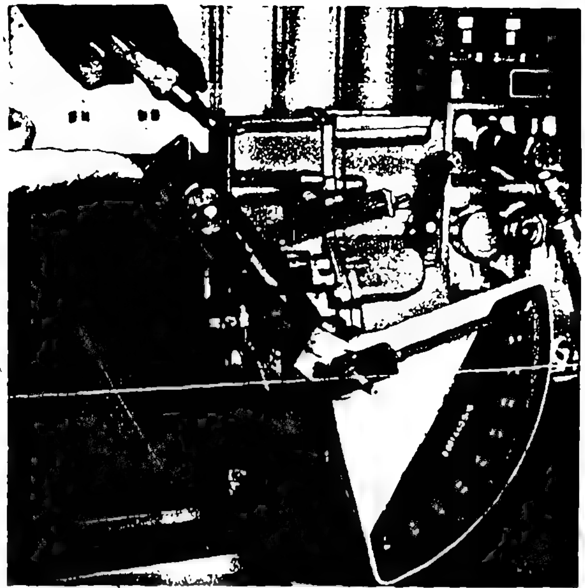
Set the speed to 0 rev/min.

Set the dial indicator on the control-rod travel measuring instrument to 0 when the control rod is in the shut-off ("Stop") position.

Press the governor springs over by hand (flyweights in the inner position).

Move the control lever slowly from shut-off toward the maximum fuel ("Voll") position. The control lever is positioned at 0° when the dial indicator just leaves its zero mark.

Set the protractor to the zero position determined.



12

Setting the lever ratio

Caution:
do not set the control lever to a control-rod travel of more than 21 mm!

Set the speed according to the top line of the test-specification sheet, Section B, Column 2, and at the same time readjust the control lever.

Adjust the control lever so that the associated control-rod travel given in Column 3 is reached.

Read the angle shown on the protractor and **record** this value because it is required for later measurements, for example Fig. 19.

If the control-rod travel given in Section B, Column 3, is not reached, or if the angle (Column 1) differs by more than ±3° from the specified value, i.e., in event of larger deviations, the position of the sliding block (Fig. 3) must be changed. When doing this, ½ turn (shorter adjusting pin) means about 2.25 mm less control-rod travel.

Correct for small deviations by means of shims under the plate cam stop. In this case, reducing the thickness of the shims by 0.15 mm results in about 1 mm less control-rod travel.

The prestress of the governor springs must not be changed!

B. Governor Settings

Upper rated speed			Intermediate rated spe	
Degree of deflection of control lever	rev/min	Control rod travel mm	Degree of deflection of control lever	[illegible]/min
1	2	3	4	5
approx. 68	1150	15,0 - 18,2	–	–
	1380	0 - 1,5		
approx. 62	1100	15,0 - 17,8		
	1150	10,2 - 13,8		
	1200	5,0 - 10,0		
–	1250	0 - 5,6		
	1320	0		

Torque control travel a = mm

13

1 **Test Specifications**

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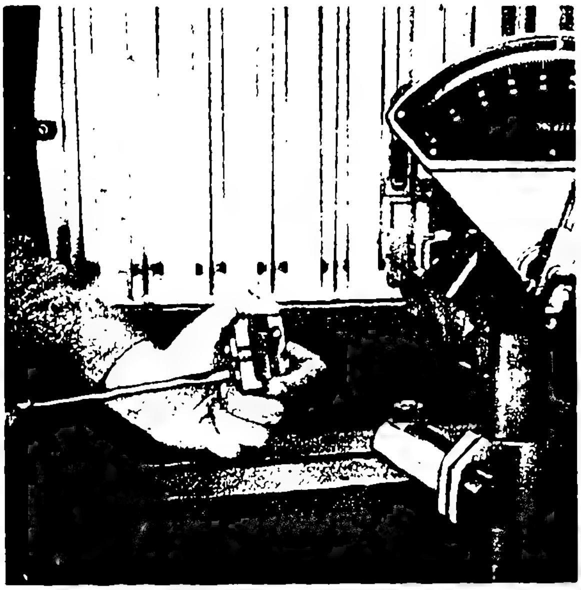
VDT-WPP 001/4 .. ..

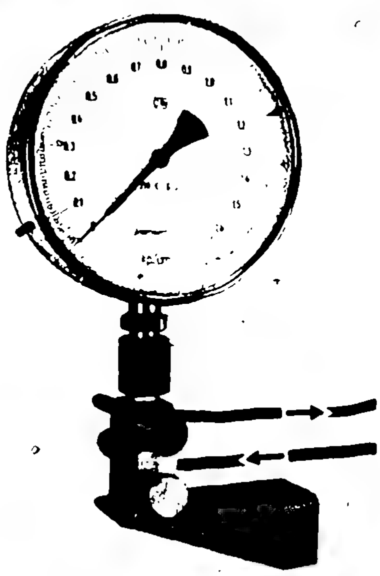
Section B .. **Edition**

Lower rated speed			Sliding sleeve travel Torque-control travel	
Degree of deflection of control lever		Control rod travel		
	rev/min	mm	rev/min	mm
7	8	9	10	11
approx. 10	100	6,6 - 8,0	0 - 70	Start
	250	5,0 - 6,6	200	0,5 - 1,2
	400	2,9 - 4,6	480	5,2 - 4,0
	550	1,2 - 2,6	800	4,8 - 5,2
	700	0	1270	8,3
			1420	Finish (11
			1510	

14



15



16

Testing speed regulation

Upper nominal speed
Test specification sheet, Section B, Columns 1–3.

Test the governor according to the data given in the test specification sheet with increasing and decreasing speeds.

The control-rod travel difference must not be more than 2 mm.
If tolerances are exceeded, adjustment made according to Figs. 3, 6, 8, 11, 12, or 13 are incorrect.
The prestress of the governor springs must not be changed!

Lower nominal speed
Test specification sheet, Section B, Columns 7–9.

Move the control lever back until the specified control-rod travel values are reached at the speeds given.
If tolerances are exceeded, adjustments made according to Figs. 3, 6, 8, 11, 12, or 13 are incorrect.
The spring tension must not be changed!

Fitting the full-load stop

Adjust the stop lug so that it is positioned parallel to the base plate.

Control lever to shut-off.

Fit the full-load stop with seals on the governor housing.

As a result of simplifications made in design and adjustments, the sequence of testing steps starting with Fig. 15 has been partially changed.
The same applies for combinations with an MPC on the drive side.
(Information on this point is given on pages 16 and 17.)

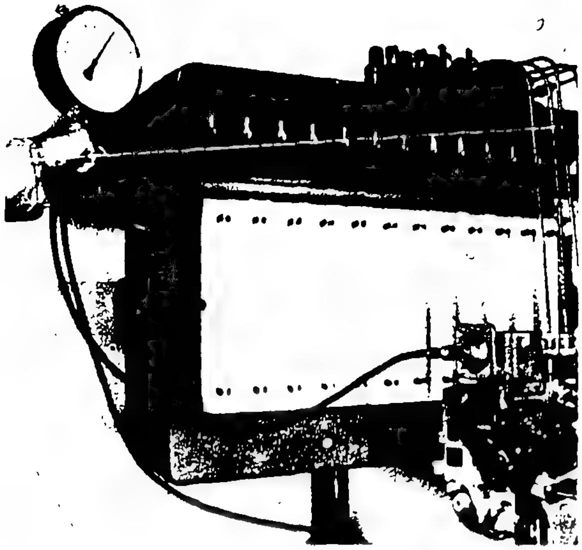
Testing the manifold-pressure compensator (MPC)
Test specification sheet, Section D.

Connect the pressure regulator to the **lower** connector on the adjustment throttle, and connect the MPC to the **upper** connector on the throttle:

adjustment screw "a" (white, lower) is used to set the pressure,
adjustment screw "b" (black, upper) is used for leakage tests.

Testing the MPC for leaks

Set the charge-air pressure to 1.0 bar at adjustment screw "a" on the adjustment throttle; close adjustment screw "b" and shut off the air supply.
The pressure gauge must not register a pressure drop.



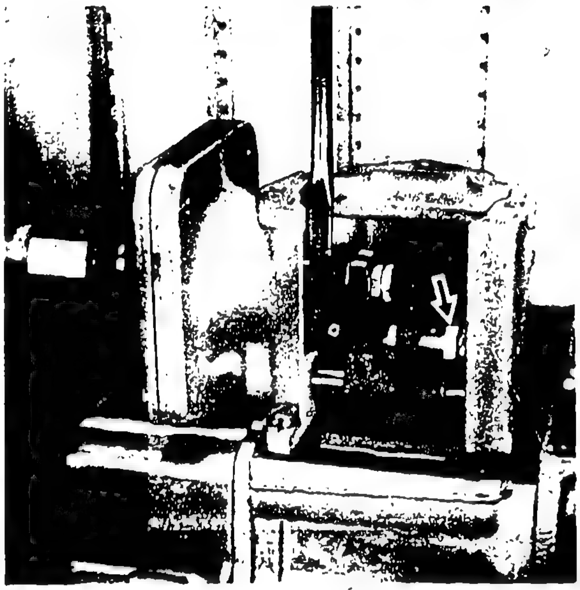
17

Checking the MPC adjustment

Increase the pressure of the compressed air slowly from about 0 bar and observe the full-load stop screw (1) in the MPC.

At the charge-air pressure given in the test specification sheet, Section C, Column 1, the full-load adjustment screw must be positioned firmly at the limit stop.

If necessary, reduce the tension on the diaphragm spring in the MPC by turning the notched nut (15).



18

Setting the rocker
Test specification sheet, Section B, Columns 10 and 11 or Section 6, Column 8.

Applies only for full-load stop with "bent" rocker guide track (Fig. 19).

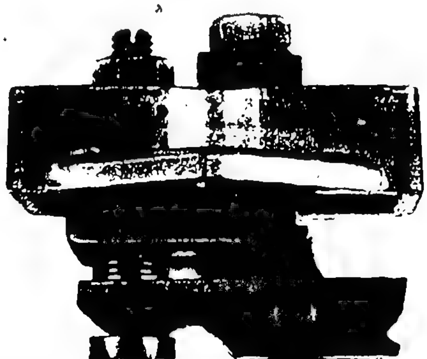
If the governor is fitted with an MPC, set the charge-air pressure to the maximum value (test specification sheet, Section C, Column 1).

Set the speed to the value given in the box (test specification sheet, Section C, Column 8 or Section B, Column 10) and at the same time readjust the control lever.

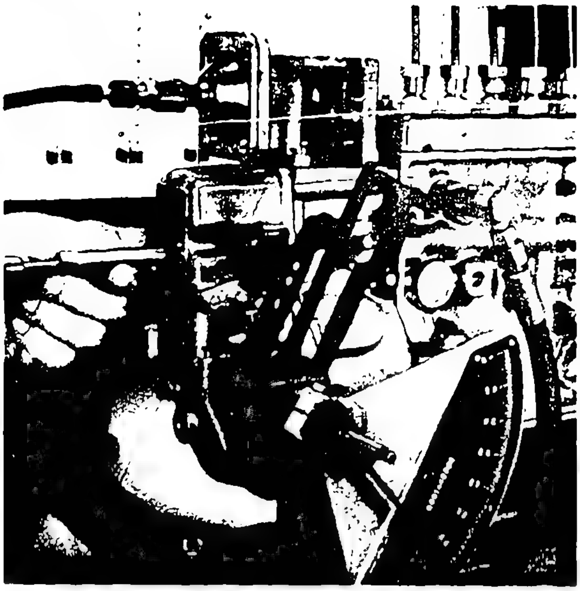
Clamp the control lever at the angle determined according to Fig. 13.

Let the rocker traverse the rocker guide track.

Change the adjustment screw (5) on the rocker and observe the dial indicator.



19



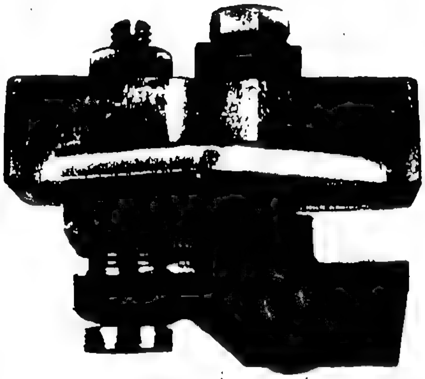
20

Find the point of reversal and set it.
The largest possible control-rod travel should be set at the rocker in the range in which the control-rod travel first increases and then decreases with the same direction of adjustment.
Secure the adjustment screw on the rocker with the lock nut.

Checking the rocker adjustment

Increasing and decreasing the adjustment speed (test specification sheet, Section B, Column 10 or Section C, Column 8, value given in box) results in a smaller control-rod travel.
The maximum control-rod travel must be measured at exactly the speed given in the box.

Set the speed to exactly the value given in the box.



21

Applies only for full-load stop with straight rocker guide track (Fig. 21).

If the governor is fitted with an MPC, set the charge-air pressure to 0.

Operate the pump at below the idle speed.

Slowly increase the speed and by repeatedly moving the control lever slowly forward determine the speed at which the rocker moves forward under the stop cam to "Start".
This switching operation should take place at 50–100 rev/min below the idle speed.

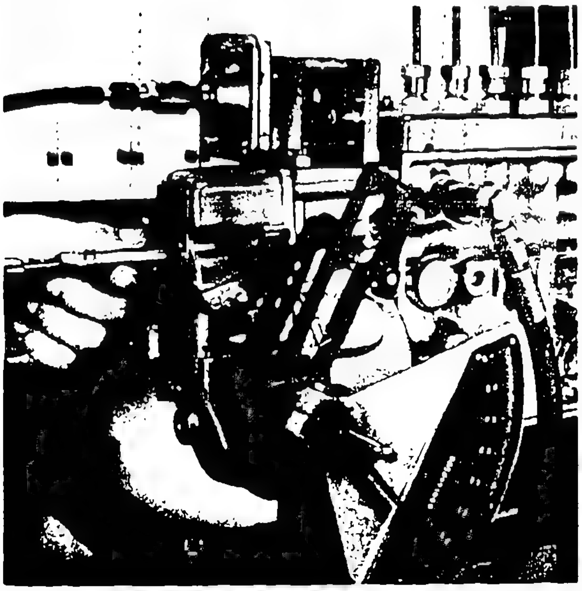
Turning the rocker adjustment screw (5) to the right shifts the switching point to a higher speed.

Secure the rocker adjustment screw with a lock nut.

With an MPC, set the charge-air pressure to the maximum value (test specification sheet, Section C, Column 1).

Set the speed (test specification sheet, Section B, Column 10, value given in box) exactly and at the same time readjust the control lever.

Clamp the control lever at the angle determined according to Fig. 13.



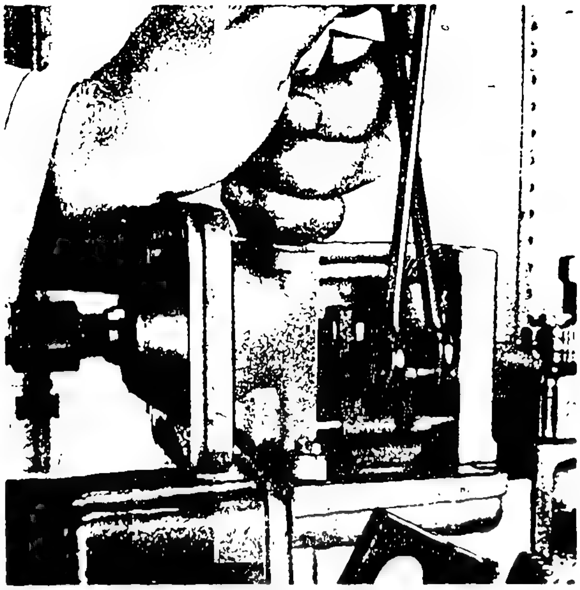
22

Setting full-load control-rod travel

Set the control-rod travel (test specification sheet, Section B, Column 11, value given in box) at the full-load stop screw (1).

Lock the full-load adjustment screw after every adjustment.

After the adjustment of the full-load control-rod travel, the test (set rocker) starting with Figs. 19 and 20 or Figs. 21 and 22 must be repeated.



23

Testing the torque control
Test specification sheet, Section B, Columns 10 and 11.

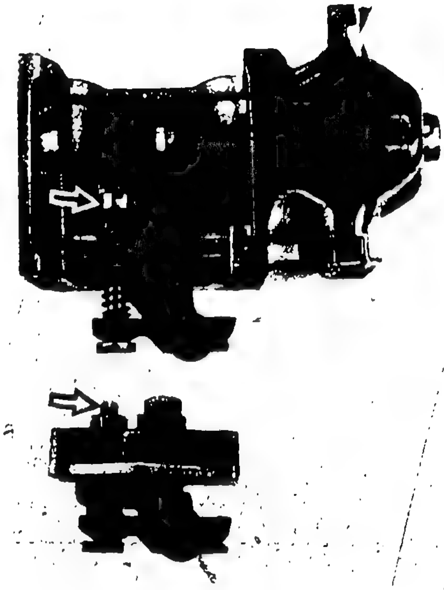
With an MPC, set the charge-air pressure to the maximum value (test specification sheet, Section C, Column 1).

Set the speed to the values specified under "Torque Control" in the test specification sheet and read the control-rod travel values.

The control-rod travel values specified can only be reached if the adjustments described above (Figs. 3, 6, 7, 8, 11, 12, and 13) have been made with the greatest accuracy.

Turn the adjustment screw (8) at the stop lug until the control-rod travel values can be reached as exactly as possible at the corresponding speeds.

Turning this screw inward increases the control-rod travel values at high speeds and reduces these values at low speeds.
As a result, the rocker and full-load adjustment must be repeated!

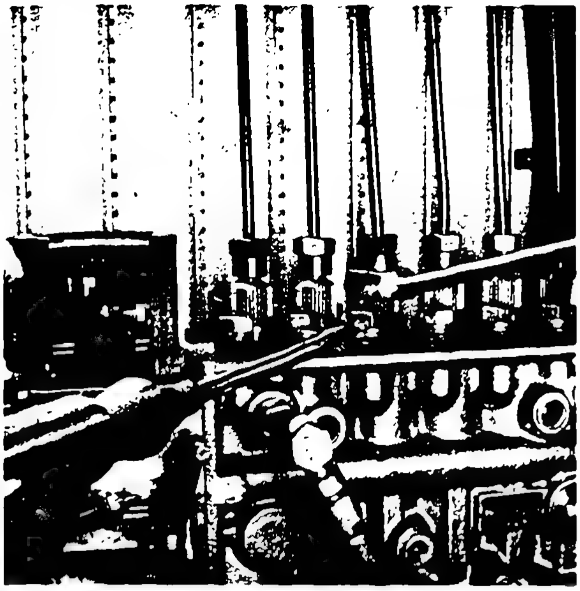


24

Repeat the tests described starting with Fig. 19.

The **rocker adjustment** (Fig. 14), the **full-load adjustment** (Fig. 23), and the **torque control** (Fig. 24) affect each other!
The corrections become smaller and smaller as the nominal values are approached.

After every readjustment secure the adjustment screws with lock nuts!



25

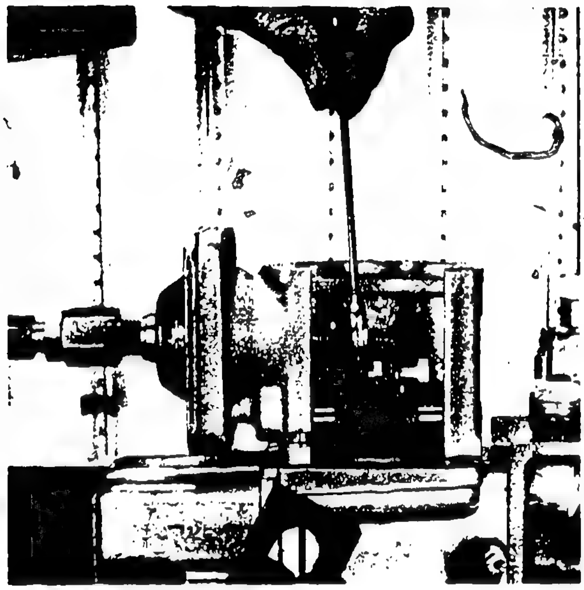
Testing full-load delivery
Test specification sheet, Section C, Columns 1, 2 and 4, 5.

With an MPC, use maximum specified charge-air pressures for the tests.

The specified full-load delivery values should not be corrected at the governor full-load stop (full-load delivery, torque control, and start locking affect each other).

Small deviations can be corrected at the fine adjustment screw (4) (about ±0.2 mm control-rod travel).

Larger deviations must be corrected on the basis of uniform fuel delivery (Section A, value given in box).

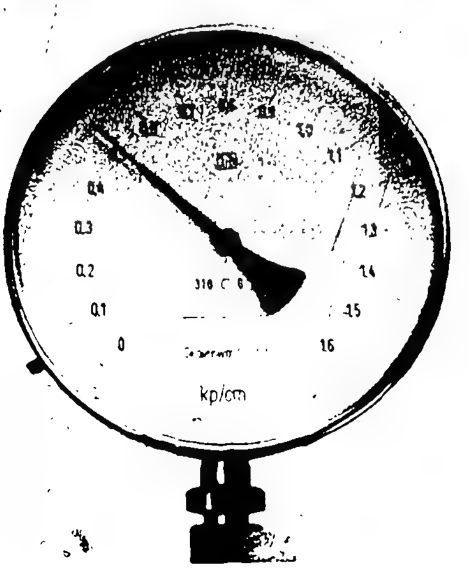


26

Setting intake volume
Test specification sheet, Section C – values with 0 bar data.

Control lever to maximum fuel ("Voll") – pressure 0 bar.

Set the fuel delivery given in the test specification sheet, Section D, with a charge-air pressure of 0 bar, using the stop nuts (14) at the MPC.



27

Testing diaphragm and diaphragm spring in MPC
Test specification sheet, Section D.

Set the speed specified.

Test made with falling pressure = control-rod-travel decrease
Set the charge-air pressure to the maximum value (test specification sheet, Section C) and set the dial indicator to 0.

Or

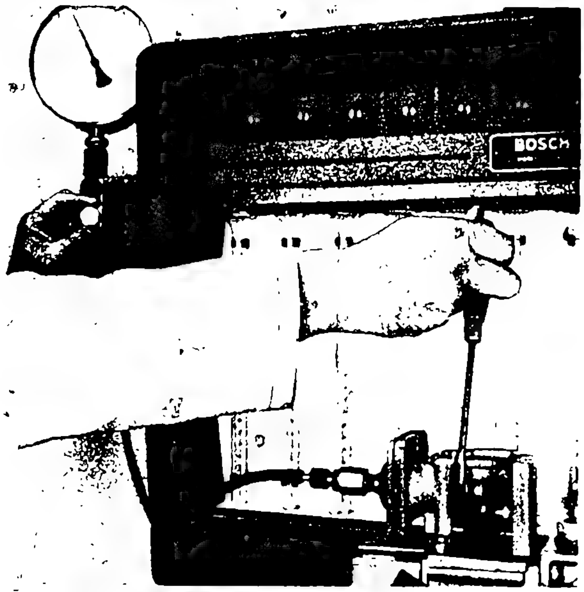
test made with rising pressure = control-rod-travel increase
At a charge-air pressure of 0 bar set the dial indicator to 0.

Set the charge-air pressure to the value specified under "**Adjustment**" in the test specification sheet.

Set the associated control-rod travel at the notched nut (15) on the MPC.

Set the charge-air pressure to the value specified under "**Measurement**" in the test specification sheet and read the dial indicator.

If the control-rod travel is outside the tolerance, the diaphragm or the diaphragm spring in the MPC must be replaced.



28

Setting the speed limitation
Test specification sheet, Section C, Column 3.

Remove the protractor.

Turn the control lever over or install the original control lever.

With an MPC, set the charge-air pressure to the maximum value.

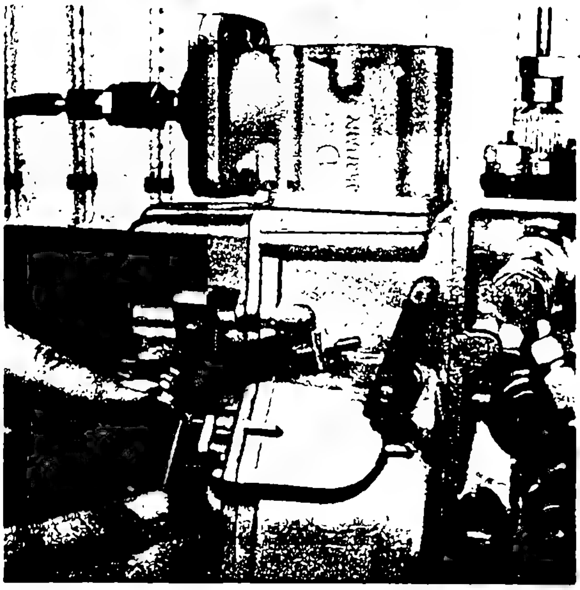
Increase the speed and at the same time readjust the control lever.

At the speed specified in the test specification sheet, Section C, Column 1, set the dial indicator to 0.

Set the speed given in Column 3.

Control lever at limit stop.

Set the stop screw so that the dial indicator shows a decrease of about 1 mm in the control-rod travel.


29

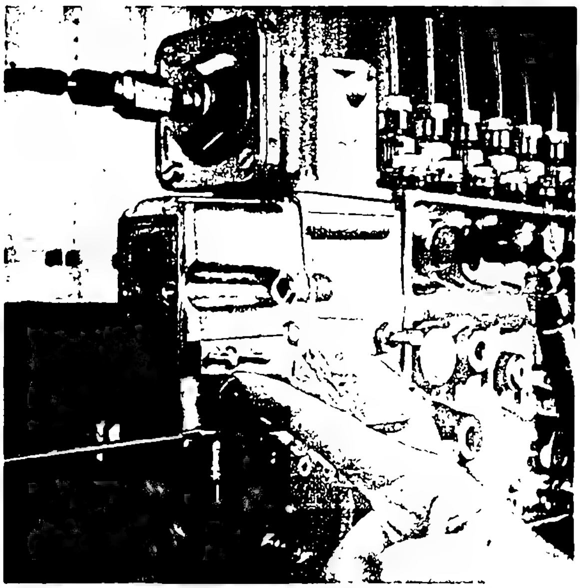
Setting the idle and shut-off stop

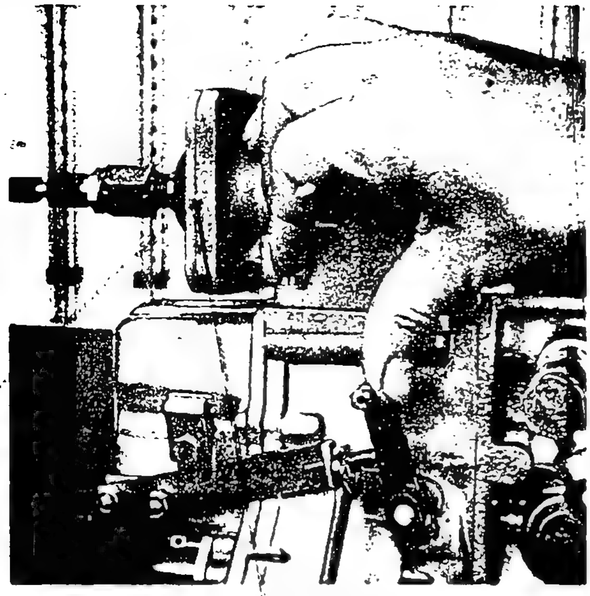
This applies only for **governors without a stop lever.**

Setting the shut-off stop screw

Set speed to 0 rev/min.
Control lever to shut-off ("Stop").
Release the shut-off stop screw and set the dial indicator to 0.

Set a control-rod travel of about 0.5 mm at the shut-off stop screw and secure the stop screw with a lock nut.


30



31

Applies only for **governors with a stop lever.**

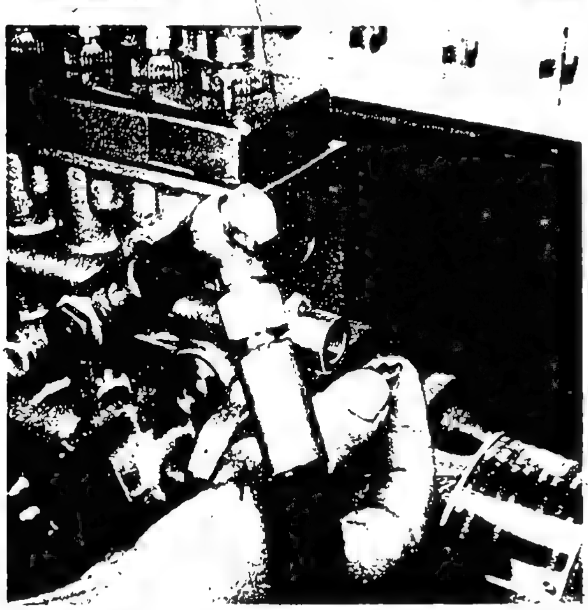
Setting idle

Set the speed according to the test specification sheet, Section C, Column 6.
The control lever is positioned against the idle stop.

Adjust the stop screw until the specified fuel delivery is reached.
Secure the stop screw with a lock nut.

Setting the shut-off stop

Set speed to 0 rev/min.
Pull the shut-off lever to "Stop".
Release the shut-off stop screw and set the dial indicator to 0.



32

Set about 0.5 mm of control-rod travel at the shut-off stop screw and secure the stop screw with a lock nut.

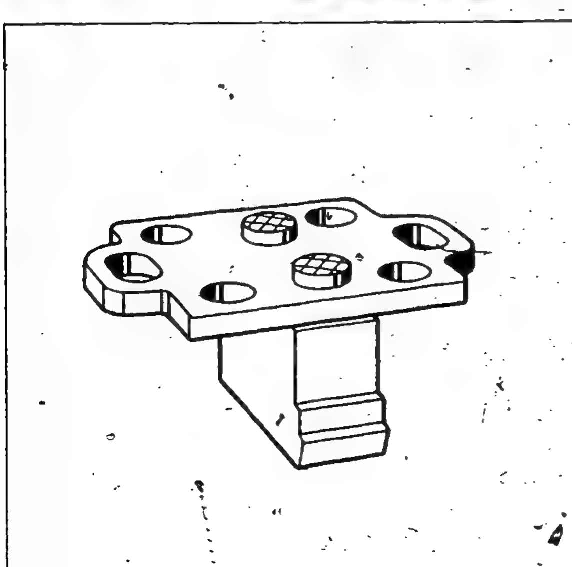
Setting the starting fuel delivery
Test specification sheet, Section C, Column 6.

Remove the control-rod travel measurement instrument.
Control lever at limit stop.
Set the speed according to the test specification sheet.

Limit the starting fuel delivery using the stop screw and the control rod sealing cap.

Replace all covers with new seals.

Remove the pump from the test bench and lead-seal it.



33

Simplified full-load stop

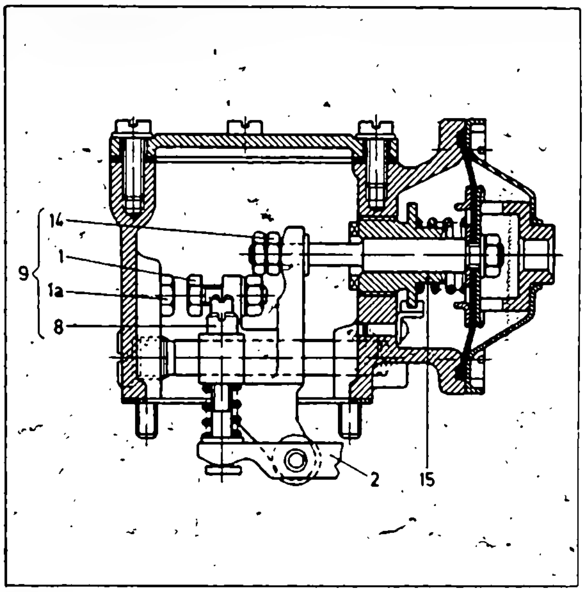
The full-load stop shown in Fig. 19 has been modified in some of the governors as shown in Fig. 33. As a result, the following applies:

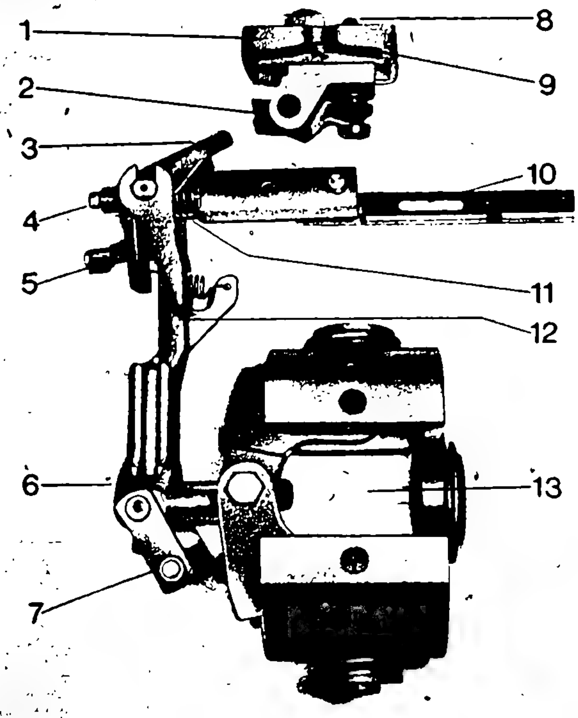
The adjustment of the horizontal position of the stop is omitted and therefore the correction of the torque control is also omitted.

The full-load control-rod travel, and thus the full-load delivery, are set by shifting the stop in the recess in the governor housing.

List of parts mentioned in text

1 Full-load stop screw
1a Full-load stop
2 Rocker guide
3 Rocker
4 Fine adjustment
5 Rocker adjustment screw
6 Sliding block
7 Swivelling lever
8 Adjustment screw
9 Full-load stop (complete)
10 Control rod
11 Strap
12 Fulcrum lever
13 Flyweight assembly
14 Stop nuts
15 Notched nut



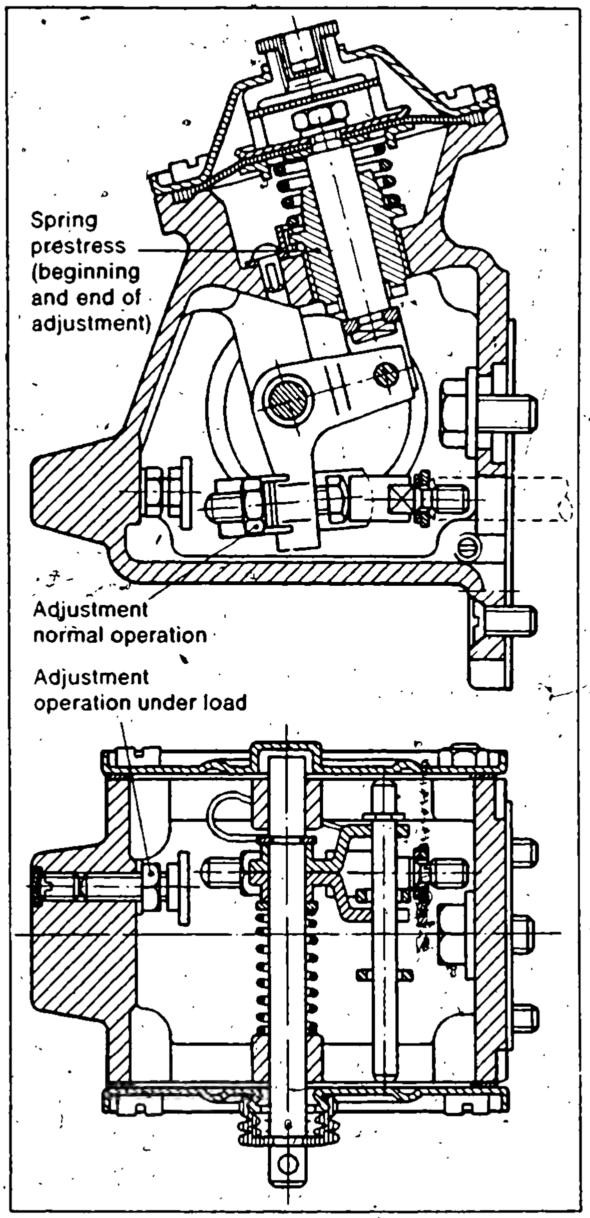


RQV .. K .. governor with an MPC on the drive side results in an additional combination:

In this case, the full-load delivery is adjusted by the stop screw at the elbow lever in the MPC. When operating under load, full-load delivery values are set with the adjustable stop lug (Fig. 34) in the governor housing. The stop screw in the MPC housing is then set to the full-load control-rod travel +0.5 mm.

The testing sequence, therefore – presented briefly – is as follows
(using Test Specification Sheet SCA 11,0 p as an example):

0.7 bar n = 850 rev/min
= full-load at stop lug,
0.7 bar n = 1100 rev/min
= full-load at stop lug (check),
0 bar n = 500 rev/min
= full-load at elbow lever in MPC,
0.7 bar n = 1100 rev/min
= full-load control-rod travel +0.5 mm at stop screw in MPC housing.



34

After-sales Service Instructions

Testing

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VDT-W-420/303 En
Suppl. 1
Ed. 1

RQV..K..Governor

with Manifold Pressure Compensator
(MPC) on the drive side

BOSCH After-sales Service
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Equipment

M5

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Department for Technical Publications KH/VDT
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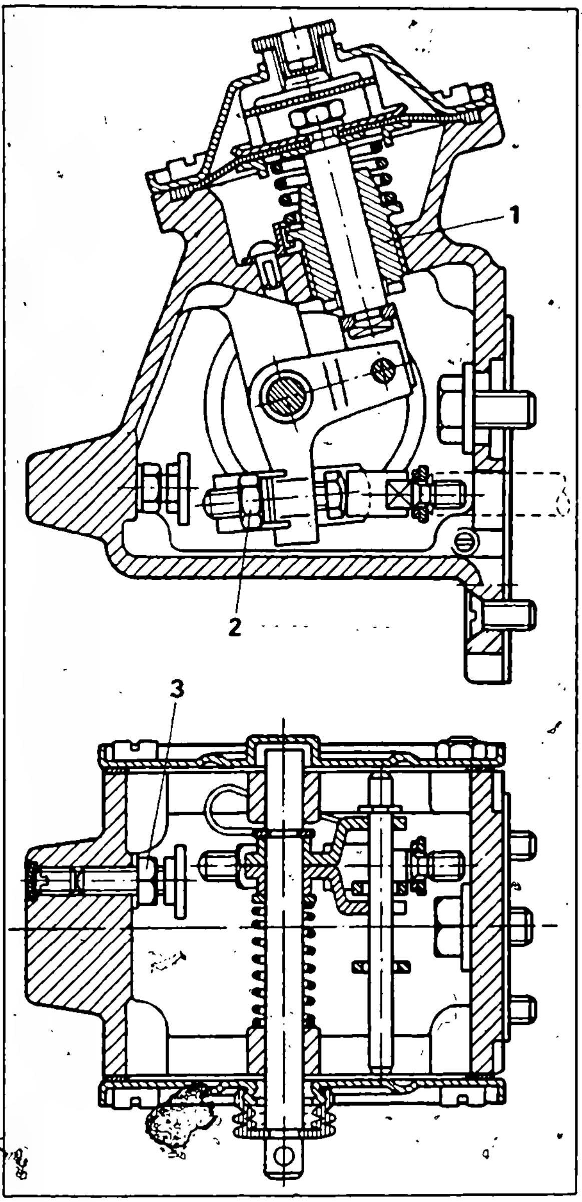
(6. 78)

This Supplement renders page 17 of VDT-W-420/303 invalid; the latter is replaced by the following expanded text:



1

RQV..K..Governor with an MPC on the drive side results in an additional combination:

In this case, when the pressure charger has not yet built up enough pressure for the MPC to respond, the full-load delivery is taken up by the stop screw of the elbow lever in the MPC. When the pressure charger is delivering sufficient pressure for the MPC to respond, full-load delivery values are set with the adjustable stop lug (Fig. 3) in the governor housing. The stop screw in the MPC housing is then set to the full-load control-rod travel + 0.5 mm.

In accordance with the above test instructions the testing sequence from Fig. 12 onwards is briefly as follows: (e. g. SCA 11,0 p)

1.
Measure the control-rod travel using the control-rod setting device 1 688 130 095 (EFEP 565), magnet and 30 mm (1/10) dial indicator.
Fabricate clamping piece as shown in sketch and fasten to the end of the control rod (Fig. 4).
Assemble control-rod setting device and apply magnet to clamping piece.

Caution!
The control lever 0° position is the point at which the control-rod travel dial indicator just leaves the zero position.

2.
Set the lower nominal speed,
Test-specification sheet, Section B, Columns 7 ... 9.
The specified control-rod travel values must be reached. See notes on Fig. 14 (VDT-W-420/303).
The MPC is taken off, or the stop screw on the elbow lever in the MPC is removed so that the control rod is exposed. Carry out governor friction test with increasing and decreasing speed. Check control rod for freedom of movement.

1 = Spring prestress (beginning and end of adjustment)
2 = Adjustment, without pressure charger operating fully
3 = Adjustment, with pressure charger operating fully, + 0.5 mm control-rod travel

M6

3.
Set upper nominal speed,
Test-specification sheet, Section B, Columns 1 ... 3.
See notes on Fig. 13 in VDT-W-420/303. Set 12.7 mm control-rod travel at full-load stop (Fig. 3). Set speed regulation at a speed of 1135 ... 1145 min^{-1} at the speed stop screw. Replace MPC, if removed.

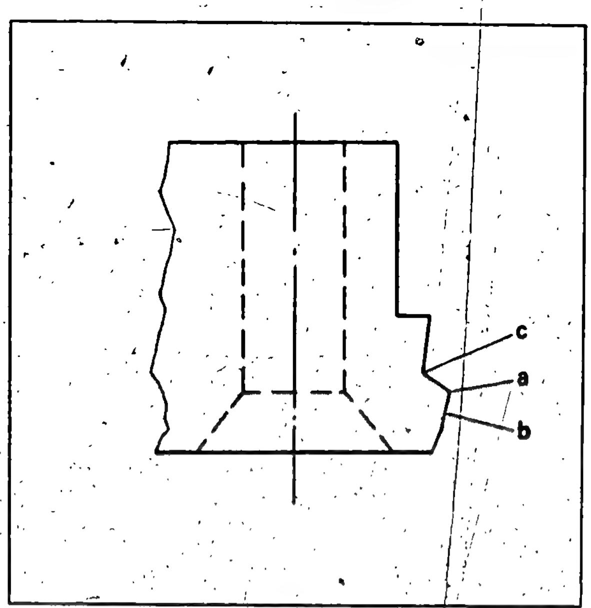


Fig 2 Enlarged lug for full-load stop.

a = lower edge (n = 850 min^{-1}; adjust with lug and rocker)
b = lower surface (n = 600 min^{-1}; adjust with rocker)
c = lower notch (n = 1100 min^{-1})

2

4.
Set rocker,
Test-specification sheet, Section C, Column 8.
When speed drops from 850 min^{-1} to 700 min^{-1} additional control-rod travel of 0.1 mm, i. e. 12.8 mm, and from 700 min^{-1} to 600 min^{-1} a further additional 0.1 mm of control-rod travel, i. e. 12.9 mm, must be reached (in all, 0.2 mm additional control-rod travel). Correct at the adjusting screw of the rocker (Fig. 3).

Caution!
Always reset full-load stop (Fig. 3) to 12.7 mm control-rod travel at speed of 850 min^{-1}.
Press starting button on the MPC. Measure starting control-rod travel (approx. 21 mm).
Set speed to 1100 min^{-1}. Control-rod travel of 13,5 mm must be reached.
Set full-load control-rod travel plus 0.5 mm at the stop screw in the MPC housing (text of Fig. 34 in VDT-W-420/303) at speed of 1100 min^{-1} and 0.7 bar.

5.
Set intake volume,
Test-specification sheet, Section C, Columns 4 ... 5.
At a speed of 500 min^{-1} (approx 11.65 mm control-rod travel) set the specified volume at the stop screw of the elbow lever (Fig. 1).

6.
Test MPC,
Test-specification sheet, Section D.
At a speed of 850 min^{-1}, 0.40 ... 0.42 bar, 12.7 + 0.1 mm control-rod travel, beginning of adjustment.
0.20 ... 0.24 bar, 11.65 + 0.1 mm control-rod travel check-measurement.
If these values are not reached, correct the spring prestress at the notched nut (Fig. 1).

7.
Test MPC for leaks, see Fig. 17 in VDT-W-420/303.

8.
Test starting function. Position control lever vertically and press starting button on the MPC. The starting fuel delivery as per Test-specification sheet, Section C, Columns 6 .. 7 must be reached.

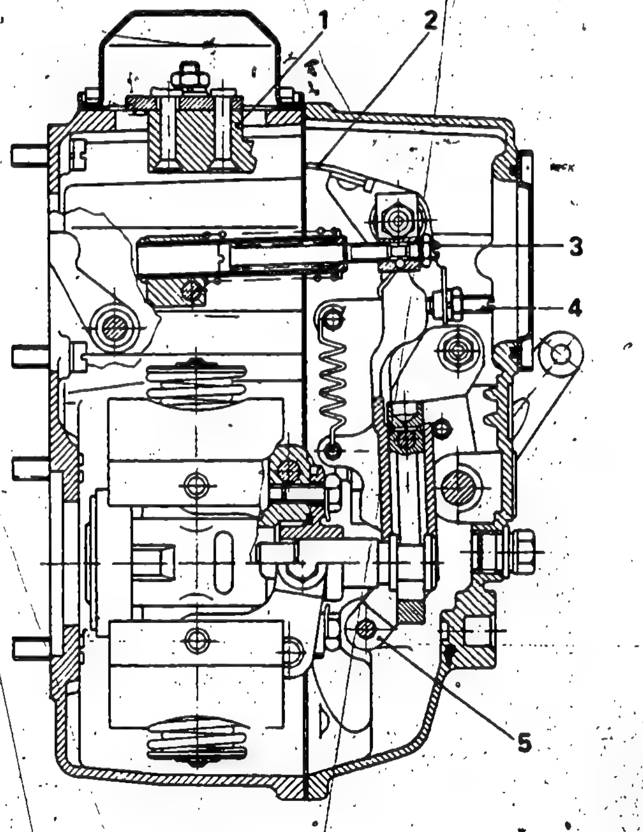


Fig. 3
1 = Full-load stop (lug)
2 = Rocker
3 = Fine adjustment screw
4 = Rocker screw
5 = Elbow lever

9.
Measure idle,
Test-specification sheet, Section C, Columns 6 ... 7.
Note dispersion at upper and lower idle.

Note:
The same testing sequence applies for Test-specification sheet SCA 11,0m1, but different control-rod travel values will result in points 3 ... 6 with this Test-specification sheet!

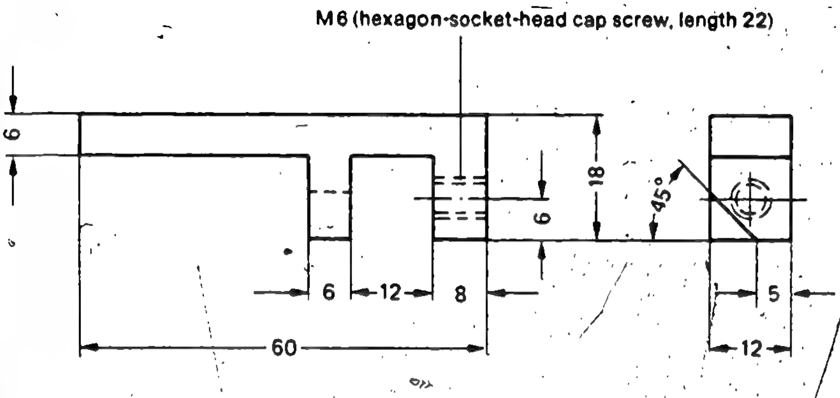


Fig. 4 Clamping piece (user-fabricated)

Register	40...46, 58
File Identity	VDT-I-420/117 En

COMPONENTS CHANGE

Components in RQV governors 8.1986

for Mercedes-Benz engines

replaces 3.1986 edition

With respect to the following governors (pump assemblies for Mercedes-Benz engine series OM 421 ..., 422.. and 423..), the components have been changed while maintaining governor designations and governor part numbers:

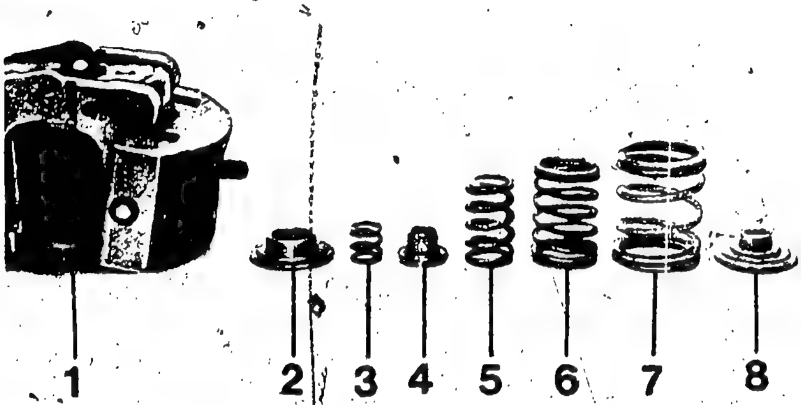
Governor designation	Part number
RQV 300-1150 PA 486-2	0 421 813 335
RQV 300-1150 PA 486-3	0 421 813 411
RQV 300-1150 PA 524-2	0 421 813 264
RQV 300-1150 PA 524-4	0 421 813 315
RQV 300-1150 PA 524-6	0 421 813 342
RQV 300-1150 PA 545	0 421 813 268
RQV 300-1150 PA 545-1	0 421 813 410

The appropriate, new components in these governors can be found in each case in the spare-part microcards EP...

For repairing the above-mentioned governors with old components, use the parts for the earlier equipment. Conversion of governors into the latest version is not necessary as long as customers do not complain of poor load take-up. Conversion to the new version can then be carried out subject to charge.

Mixed equipping of components from the old and new governor designs is not permissible!

M9



1 = Flyweight assembly
2 = Inner spring seat
3 = Auxiliary maximum-speed control spring
4 = Spring retainer
5 = Maximum-speed control spring
6 = Maximum-speed control spring
7 = Idle spring
8 = Outer spring seat

The new version is presented in the illustration above.

See SIS Microcard W-420/104 for further information.

M10

For repairing governors of the old version, the spare components relevant to the flyweight can no longer be found in the valid spare-parts lists.

For this reason, the part numbers of the components previously used are listed below:

For governors 0 421 813 264, ..315 and ..342

Item	Part numbers	Designation	Qty.
8/3	2 420 521 002	Spring retainer	2
8/5	1 424 617 051	Hel. comp. spring	2
8/6	1 424 634 040	Hel. comp. spring	2
8/7	1 424 618 015	Hel. comp. spring	2
8/8	2 420 520 004	Spring seat	2
8/16	2 420 101 027	Shim	2
8/20	1 420 100 608	Shim 0.5 mm	6
8/21	1 424 619 124	Hel. comp. spring	2
30	2 425 650 097	Gov. cover, compl.	1
30/2	1 421 332 001	Guide sleeve	1
78	1 422 033 062	Var.-fulcrum lever	1
89	1 427 132 013	Control-rod stop	1
800	1 428 199 001	Flyweight assembly	1

With respect to governor 0 421 813 411, all the above-mentioned components are the same, except Item 89 - control-rod stop 2 427 130 049.

With respect to governor 0 421 813 335, all the above-metioned components are the same, except Item 89 - control-rod stop 2 427 130 175.

The governors 0 421 813 268 and .. 410 are equipped with
Item 89 - manifold-pressure compensator 2 427 133 105, together with
Item 30 - governor cover 2 425 650 327 and
Item 800 - flyweight assembly 2 428 199 005.

No difference can be seen between the old and new versions of the governors when only examined externally. Only after the screw plug, Item 51, in the governor housing has been unscrewed can the corresponding part number of the complete flyweight assembly be read on the flyweight of the flyweight assembly (do not use as part number).

The part numbers of the previous versions are as follows:

Governor designation	Part number	Part number of old flyweight assembly
RQV 300-1150 PA 486-2	0 421 813 335	2 428 101 224
RQV 300-1150 PA 486-3	0 421 813 411	2 428 101 224
RQV 300-1150 PA 524-2	0 421 813 264	2 428 101 224
RQV 300-1150 PA 524-4	0 421 813 315	2 428 101 224
RQV 300-1150 PA 524-6	0 421 813 342	2 428 101 224
RQV 300-1150 PA 545	0 421 813 268	2 428 101 224
RQV 300-1150 PA 545-1	0 421 813 410	2 428 101 224

Test specifications

The test specifications for electric fuel-pump assemblies with the old and new components in the governor can be found in each case in a test-specification sheet on a microcard valid for both versions.

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Robert Bosch GmbH
Division KH
After-Sales Service Department for Training and Technology (KH/VSK)
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M12 M12

NEW PRODUCT

Register
File
Identity VDT-I-420/4 En

05.1986

2-STAGE MANIFOLD-PRESSURE COMPENSATOR WITH SCREWED-ON SPRING RETAINER

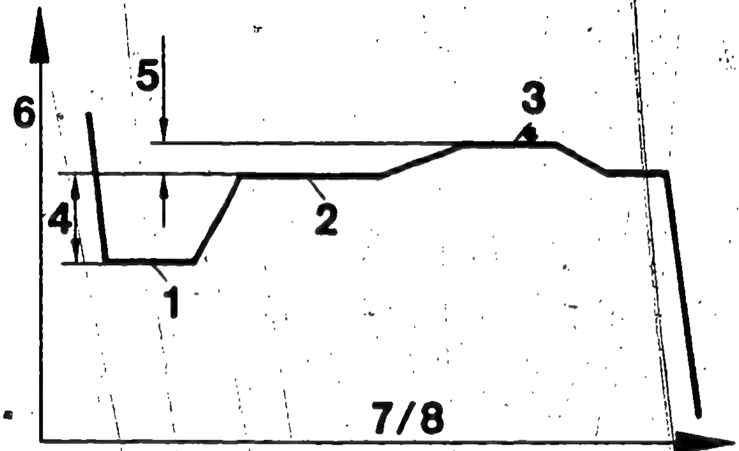
Since mid-1985, a manifold-pressure compensator with 2 working stages has been used on RQ and RQV governors. (2-stage manifold-pressure compensator).

The extended adjusting function as compared with conventional manifold-pressure compensators is obtained by the installation of a spring retainer (see Fig. 2).

The working ranges of stages 1 and 2 are shown in Fig. 1.

Provisional information on setting will be made known in a separate Technical Bulletin.

M13 MB



1 = Naturally-aspirated control-rod travel
2 = Full-load control-rod travel 1
3 = Full-load control-rod travel 2
4 = Stage 1
5 = Stage 2/dimension "a"
6 = Control-rod travel (mm)
7 = Engine speed (min^{-1})
8 = Charge-air pressure (mbar)

Operating sequence:

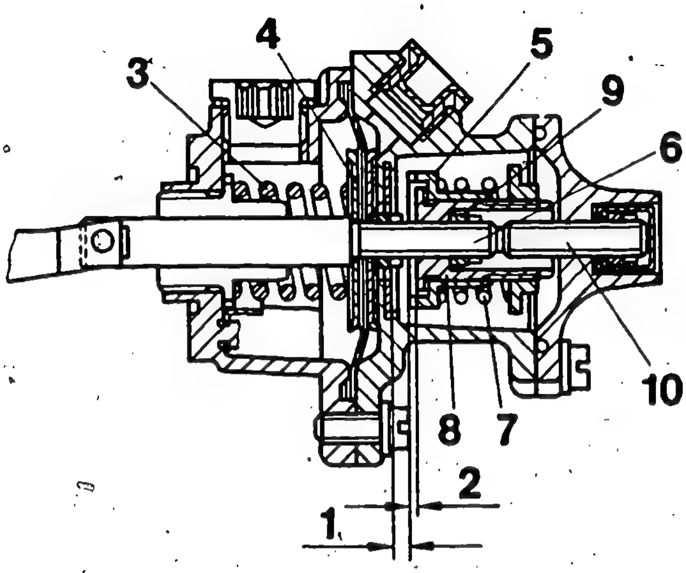
At low engine speed and without charge-air pressure, manifold-pressure compensator spring 1 (Item 3, Fig. 2) keeps the control rod at naturally-aspirated control-rod travel.
Slowly rising charge-air pressure with increasing engine speed means that, first of all, manifold-pressure compensator spring 1 is overcome by the manifold-pressure compensator diaphragm (Item 4, Fig. 2), thus resulting in full-load control-rod travel 1 (Item 2, Fig. 1).

M14

This condition is obtained as soon as, after stage 1 (Item 1, Fig. 2) has been passed through, the spring retainer (Item 5, Fig.2) has come up against the contact face in the manifold-pressure-compensator cover.

After a steady-state condition has been overcome, as the engine speed and charge-air pressure further increase, stage 2 (Item 2, Fig 2) is passed through in that the lift rod (Item 6, Fig. 2) over-comes the manifold-pressure compensator spring 2 (Item 7, Fig. 2) until the slidable sleeve (Item 8, Fig. 2) has likewise come up against the above-mentioned contact face in the manifold-pressure compensator cover. This results in full-load control-rod travel 2 (Item 3, Fig. 1).

The introduction of this new manifold-pressure compensator ensures that there is a finer adap-tation of the full-load delivery as a function of charge-air pressure and engine speed.



1 = Stage 1
2 = Stage 2
3 = Manifold-pressure compensator spring 1
4 = Diaphragm
5 = Spring retainer
6 = Lift rod
7 = Manifold-pressure compensator spring 2
8 = Slidable sleeve
9 = Adjusting nut for full-load delivery with charge-air pressure
10 = Adjusting screw for full-load delivery without charge-air pressure

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
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M16

Modification of the clamping nut

VDT-I-420/1000 En
05.1979
Supersedes Ed. 12.1978

Clamping fixture (Fig. 1) for the RQ- and RQV-Governors for the fitting and removal of the governor springs.

In order to increase the spring-supporting surface, the outside diameter of the spring seat 1 420 520 002 and .. 003, for the RQV governor, was modified.

This means that the internal bore of the clamping fixture KDEP 2894 has to be changed accordingly.

The outer clamping nut must be reworked as shown in Fig. 2.

In the case of new orders, this modification has already been taken into account.

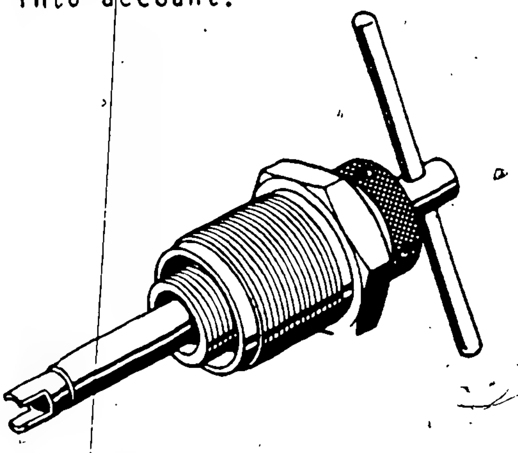

Fig. 1

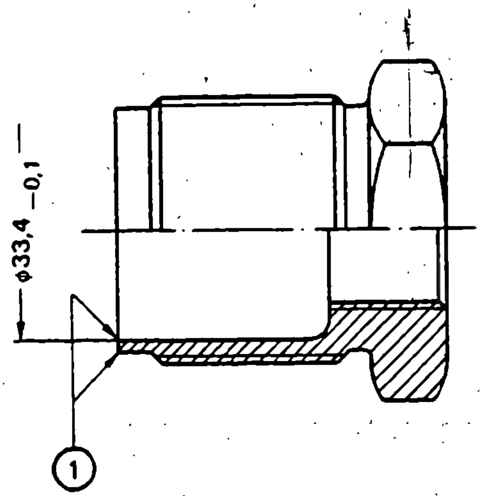

Fig. 2

1 deburr

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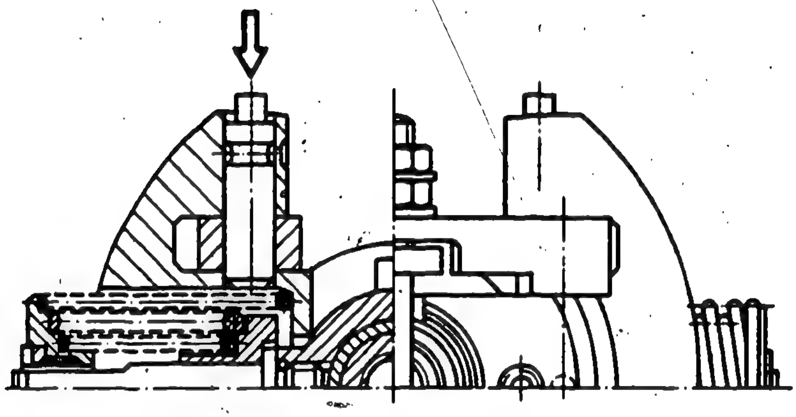
M17

LOOSE RETAINING PINS IN RQ/RQV GOVERNORS
FUEL-INJECTION PUMPS PE (S) ...P...S 3000



As of FD 347 the calking of the retaining pins in the flyweight assemblies of RQ and RQV governors has been changed. To obtain comprehensive information on the effectiveness of this change, the security of the retaining pin must be tested when servicing all PE(S).. P..S 3000 injection pumps - including those with FD before 347.

BOSCH Geschäftsbereich KH Kundendienst Kraftfahrzeug-Ausrüstung

Conduct the test as follows.

- Unscrew lateral screw plug on governor housing.
- Using flat-nose pliers, grip retaining pin and check whether it can be moved in the axial direction (see picture).
- In the case of loose retaining pins, the flyweight assembly must be renewed.

During the warranty period the renewal of the flyweight assembly is to be performed free of charge. After the warranty period a goodwill application may be made.

Warranty procedure

During the warranty period RG/AV should send defective flyweight assemblies for warranty assessment with warranty and goodwill application - outside Germany - G21 and delivery note to:

Robert Bosch GmbH
KH/LAV2 - Auspackraum
zur Weiterleitung an K5/QSG
Auf der Breit 4

D 7500 Karlsruhe 41.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD2)
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RQ, RQV... P-GOVERNOR

VDT-I-420/110 En

Modification to the control-rod compression spring

8.1981

It can occur on the RQ..P and RQV..P governors, that the turns of the compression spring (Microfiche Item 96) ride up over one another and cause the control rod to jam.
As from FD 145, the compression spring item 96 was increased in diameter as a remedial measure. As a result, the spring seat item 95 on the governor, and the thread ring item 34 on the fuel-injection pump must be changed as well.
When carrying out repairs, care must be taken that all three items are replaced.

Under item 96, three different compression springs are offered for the various governors. Details can be seen from the microfiche.

Designation	Microfiche pos'n	Old part number	New part number
Governor:			
Spring seat	95	2 420 500 000	2 420 500 042
Compression spring	96	2 424 615 015	1 424 615 023
Compression spring	96	2 424 615 007	2 424 615 024
Compression spring	96	1 424 615 037	2 424 615 025
Fuel-injection pump:			
Thread ring	34	1 413 344 000	2 413 344 001

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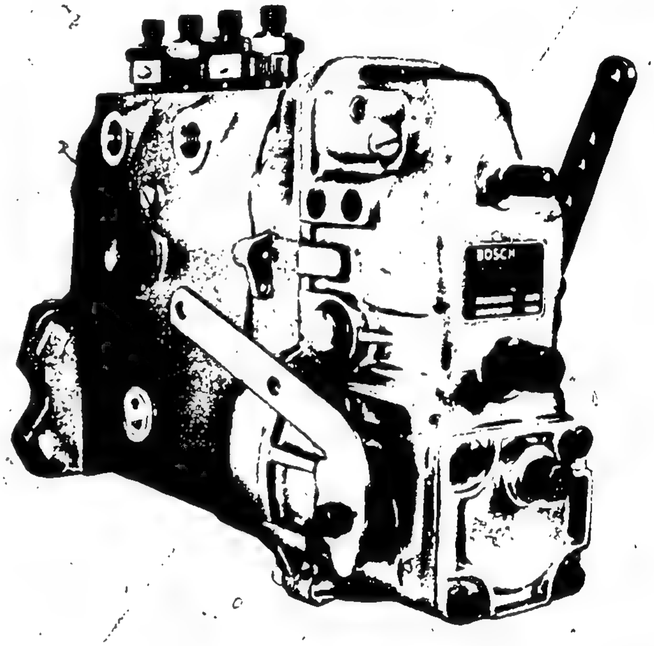
BOSCH

TEST INSTRUCTIONS

42

VDT-WPP 001/4 B Suppl. 5
Ed. 1



Mechanical Governor 0 420 . .

EP/RS . .

M21

Contents

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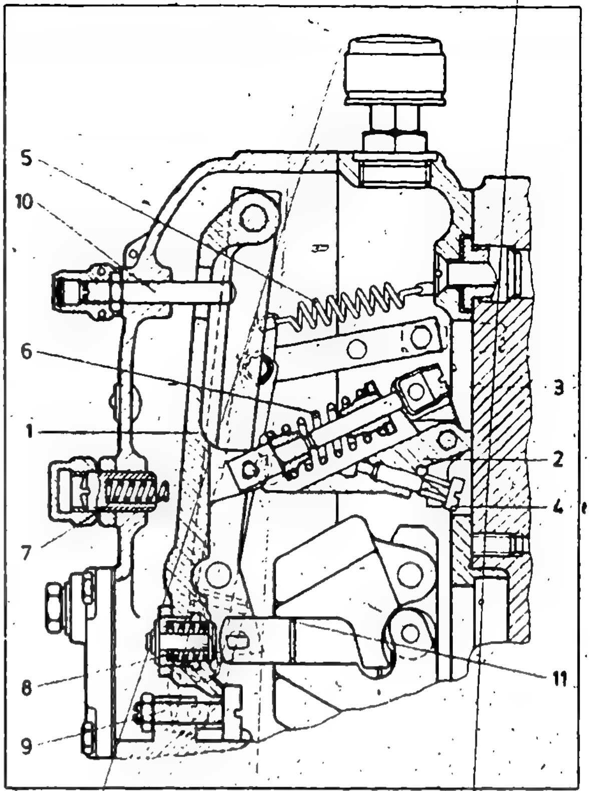
2	1. Construction
3	2. Principles of Operation
4	3. Testing the Pump
4	4. Initial Governor Adjustments
7	5. Adjusting the Governor
8	6. Adjusting the Pump and Governor together

1. Construction

Mechanical governor EP/RS.. is a maximum-minimum governor which was developed from the variable-speed governor EP/RSV... The transmission of the control lever deflection to the control rack was modified so that the control rack does not take up its full travel position until the control lever has moved to maximum deflection.
When the control level is in the idle position, the idling spring takes over the idle speed regulation.
For all other control lever positions, the pre-compressed governor spring controls the break-away.
The construction of the EP/RS governor differs from that of the EP/RSV governor by the use of a different **tensioning lever** (1), modified **swivelling lever** (2) and the rocker with the **governor spring adjusting screw** (3), as well as the **rocker adjusting screw** (4).
The remaining construction with the **torque control capsule** (8), **full-load stop** (9), **shut-off or idling stop** (10) and shims **for the sliding sleeve** (11) is the same in both governors.

WPP 00114 N.S



1

2. Principles of Operation

As engine speed increases, the centrifugal force of the flyweights increases. This centrifugal force acts against the **starting spring** (5), **governor spring** (6) and **idling spring** (7) one after the other. If the centrifugal force is greater than the spring force acting against it, the flyweights move outwards and the control rack is pulled in the shut-off direction until another spring becomes effective.

Idle position

In the control lever idle position the tensioning spring is in a non-tension position; therefore, the governor spring is out of action. Hence, the idling spring is the first spring to become effective. (Fig. 1)

Full-load position

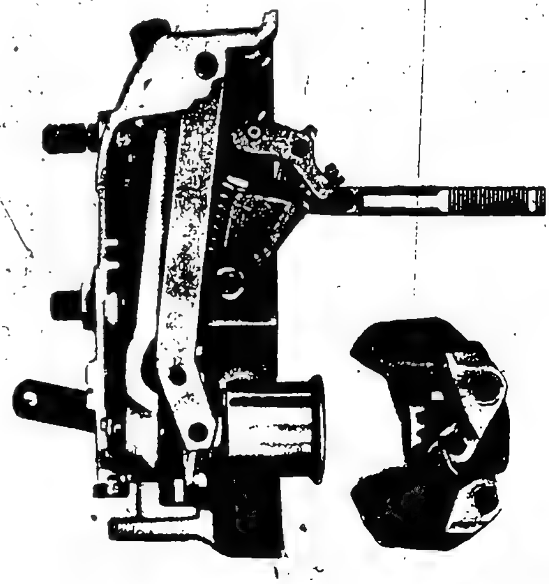
If the control lever is deflected fully then the tensioning lever, and with it the control rack, take up maximum travel position. The starting spring is overcome by the increasing centrifugal force and when full load control rack travel is reached, the pre-compressed governor spring acts against the centrifugal force. The control rack is held at full-load position.

Break-away at full-load
The governor spring does not overcome the centrifugal force until the rated speed is exceeded. The control rack is displaced from the full-load position in the shut-off direction.

Partial-load position

If though the control lever is only half deflected for example, then the tensioning lever, and with it the control rack, take up half maximum travel position. As speed increases the pre-compressed governor spring starts to act against the centrifugal force of the flyweights only after the control rack has travelled the starting distance plus half the full-load distance.

Break-away at partial load
The initial force of the governor spring is affected only by the governor spring adjusting screw, therefore the break-away from the partial load position does not begin until the rated speed is exceeded. (Fig. 2)



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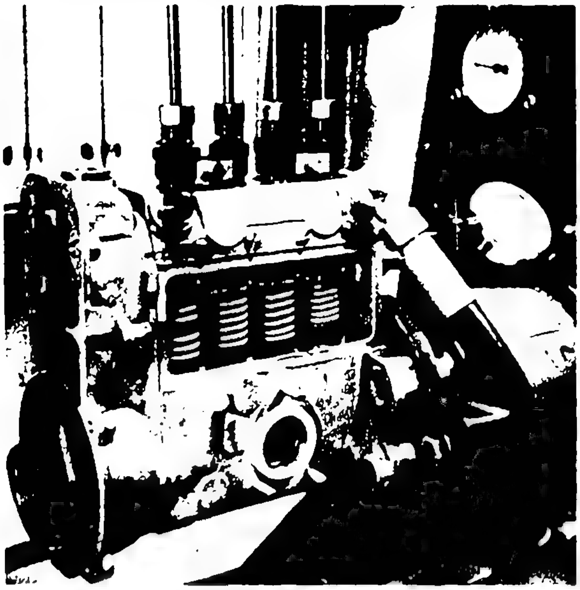


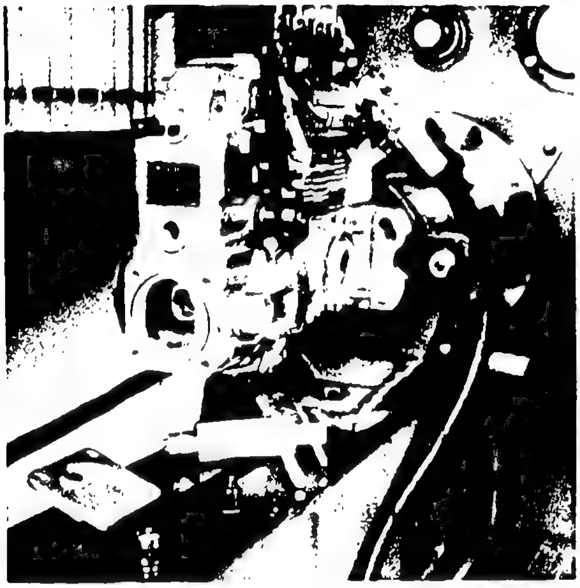
3

3. Testing the Pump

Test Specifications Sheet, Section A

Select test sheet.
Clamp the pump to the test bench.
Remove the governor cover.
Connect the pressure lines.
Fill the pump with lubricating oil.
Attach the control rack travel measuring device and set it to 0.
Set the control rack at the control rack travel framed in Section A of the test sheet.

Test the pump according to test sheet (Section A).

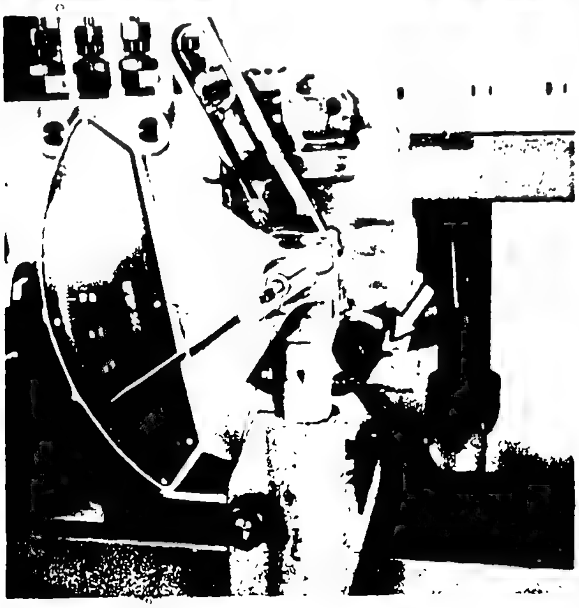


4

4. Initial Governor Adjustments

Test Specifications Sheet, Section B

Assemble governor.
Screw back the shut-off or idling stop screw and the maximum speed stop screw.
Take out the idling and torque control springs.
Fill the governor with lubricating oil.



5

Single-lever operation (special model)

Swivel the intermediate lever back so that it does not touch the stop lever eccentric when the control lever is in the shut-off position.

If necessary, remove the intermediate lever.

Position the adjusting eccentric on the stop lever as shown in the adjacent figure.

(Valid, for example, on governor models ..A 379 D and ..A 380)

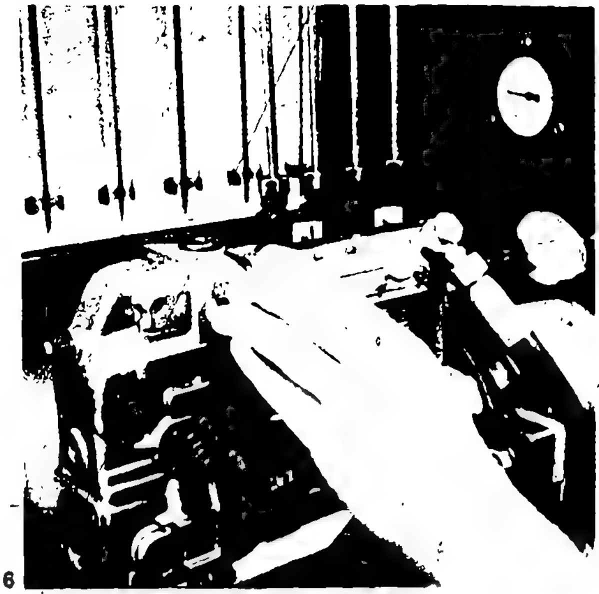
Check freedom of movement

Do not operate the pump.
Move the governor control lever from shut-off to full; the control rack must move immediately and without play to the start position.

(On A-pumps, for example, about 75° control lever deflection and approx. 21 mm/0.83 in control rack travel).

Set the stop lever or the control lever to the shut-off position. It must not be possible the push the control rack any further in the direction of shut-off.

Set the control rack travel measuring device to 0.



6

Checking position of sliding sleeve

Set the control lever so that it is about vertical.
Increase the engine speed until the governor has completely broken away. The control rack must have moved back by 0.3 to 1 mm (0.012 to 0.039 in).

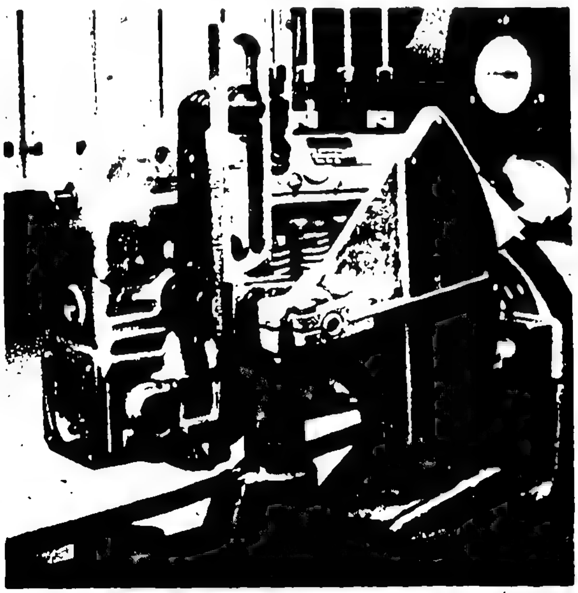
Adjust with shims between link and sliding sleeve.

Addition of 1 mm/0.039 in shim = approx.
2 mm/0.078 in less rack travel. (For illustration purposes the governor cover has been removed.)

7

Attach angle measuring device

Mount and align the angle measuring device. Move the governor control lever to vertical, clamp the angle measuring device.
Move the pointer or the scale of the angle measuring device to 40° (0° = shut-off).



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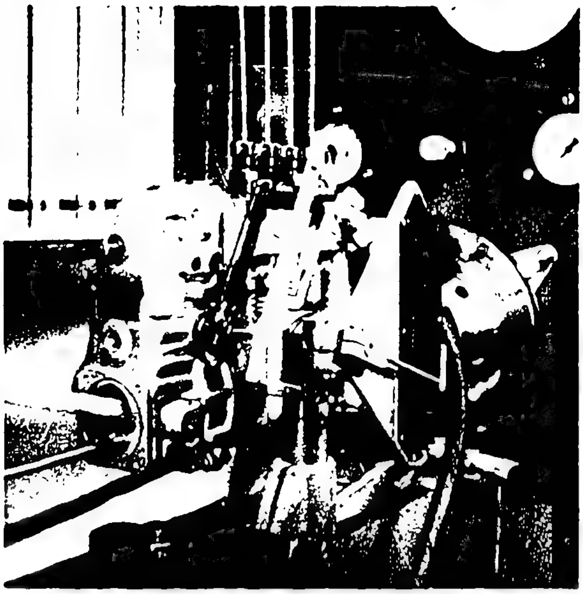
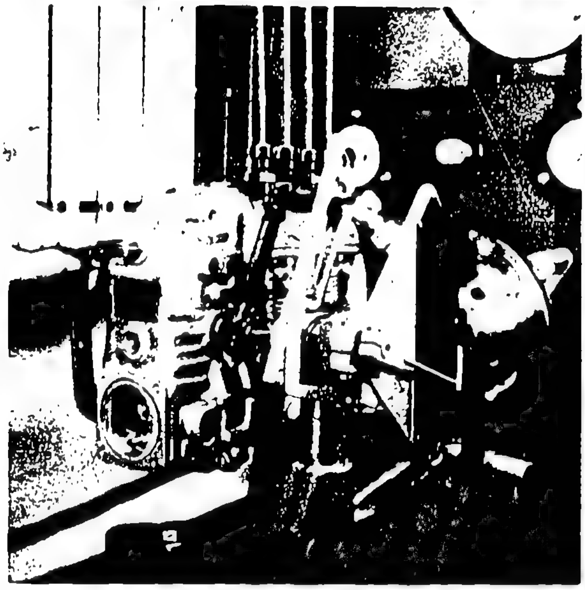


9

Initial adjustment of full-load delivery stop

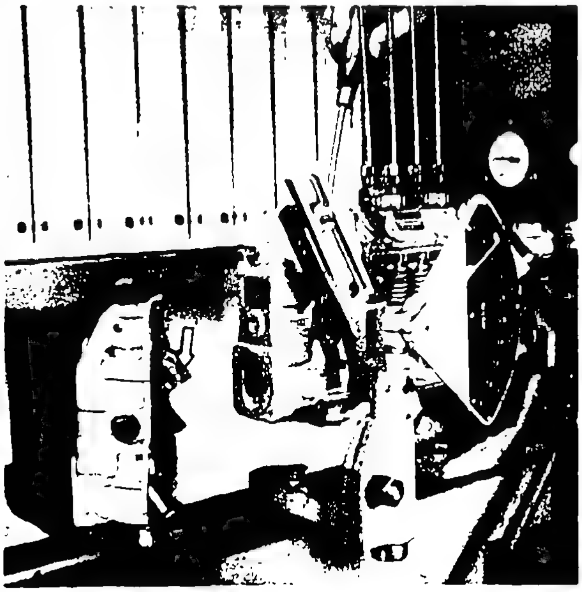
Control lever (according to Test Specifications Sheet, Section 3) at angle given in Column 1, engine speed set according to Column 2.
Set full-load delivery stop screw for control rack travel as specified in frame Column 3.
If necessary, push over the tension lever by hand.



10

Checking stopping device

If fitted, operate stopping device.
The control rack must move to shutoff and return to original position as soon as the device is released.



11

Initial rocker adjustment

Do not operate pump.
Move the control lever slowly from shut-off to full. Set the rocker adjusting screw so that some resistance can be felt approx. 5° before reaching the prescribed control lever deflection (according to Column 1).

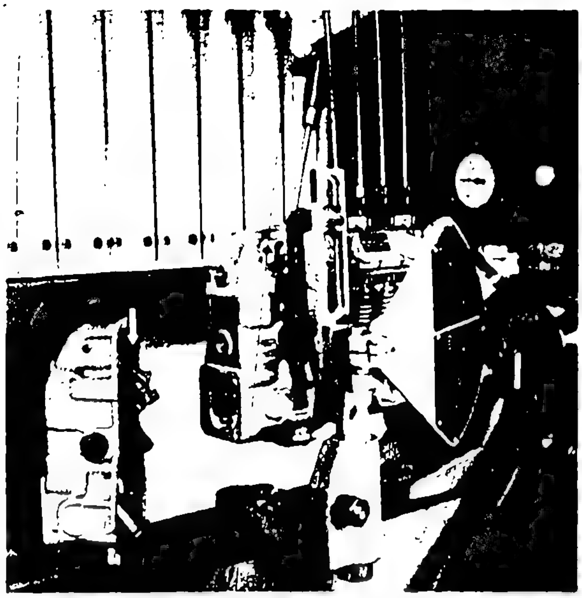
In order to set the rocker adjusting screw, move the control lever completely back so that the screw can be reached through the opening of the governor housing.

Clamp the control lever at the prescribed angle (according to Column 1).
Provisionally set the engine maximum speed stop screw; or in the case of combination governors (e.g. EP/RS 250/600 – 1250 A0 A380) note the angle of the control lever.

Initial adjustment of main spring

Set the control lever up against the engine maximum-speed stop screw or, in the case of combination governors at the angle noted previously. Slowly increase the engine speed while observing the control rack travel measuring device:
Break-away must start at 20 rev/min above the rated speed.
Adjust break-away at the adjusting screw of the governor spring.

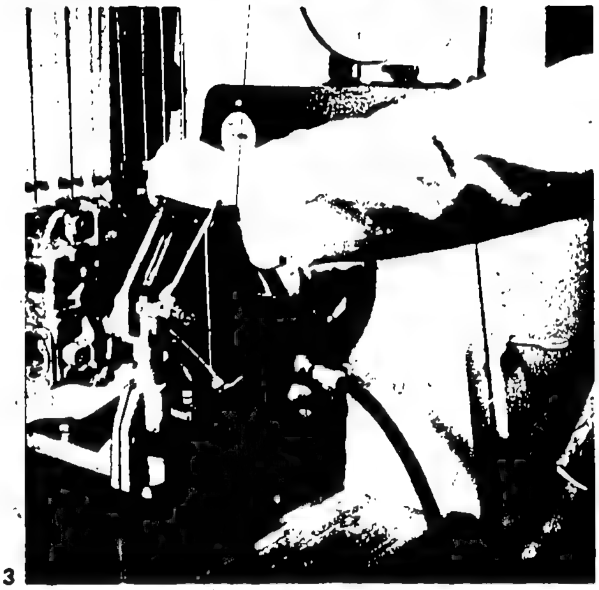
To adjust the governor spring, move the control lever back far enough so that the spring adjusting screw can be reached through the opening of the governor housing.



12

Testing governor for stability and friction

With increasing engine speed set control rack travel to approx. 6 mm/0.24 in. Read-off the engine speed. With decreasing engine speed maintain the engine speed which has just been read-off. The difference in control rack travel between that at increasing speed and that at decreasing speed is not to exceed 1 mm/0.039 in.
Set the control lever deflection as specified for maximum rated speed.
Starting at approx. 1.5 times idle speed, increase speed up to 20 rev/min below break-away.
The control rack should not travel more than 0.2 mm/0.008 in.



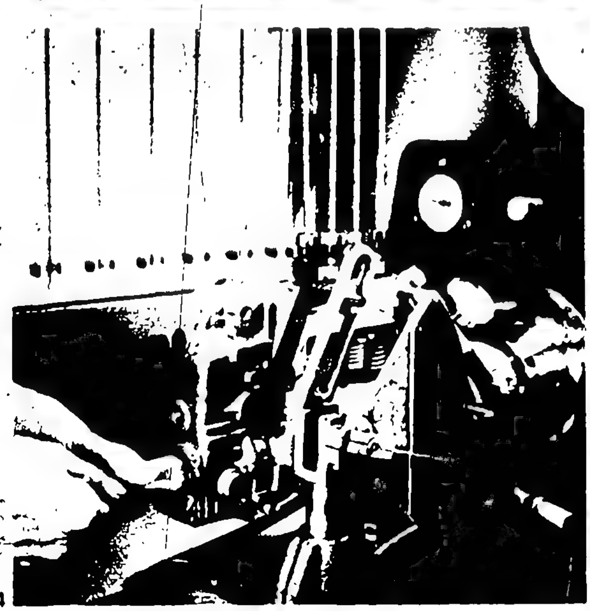
13

5. Adjusting the Governor

Test Specifications Shett, Section B

Adjusting torque control
(according to Column 10 and 11)

Set the control lever deflection as specified for maximum rated speed.
Rotate at the lowest speed specified in columns 10 and 11. Tighten the torque control capsule until the control rack travel increases by the amount specified. (Given control rack travel 0 means full-load control rack travel.)
Tighten the torque control capsule.
Test the torque control operation during falling engine speed.



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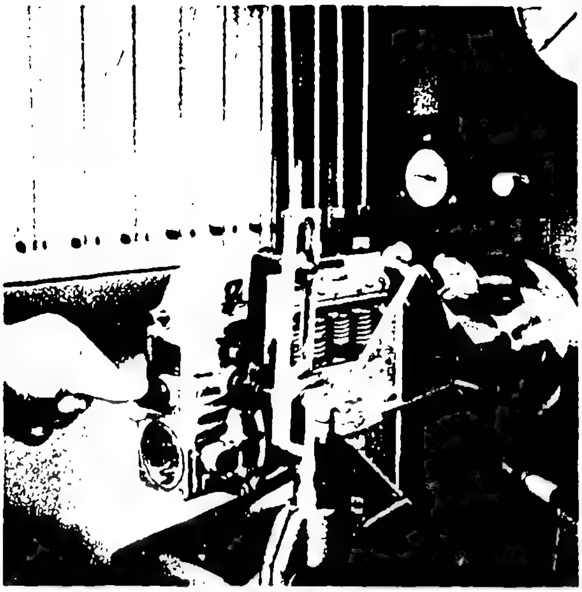
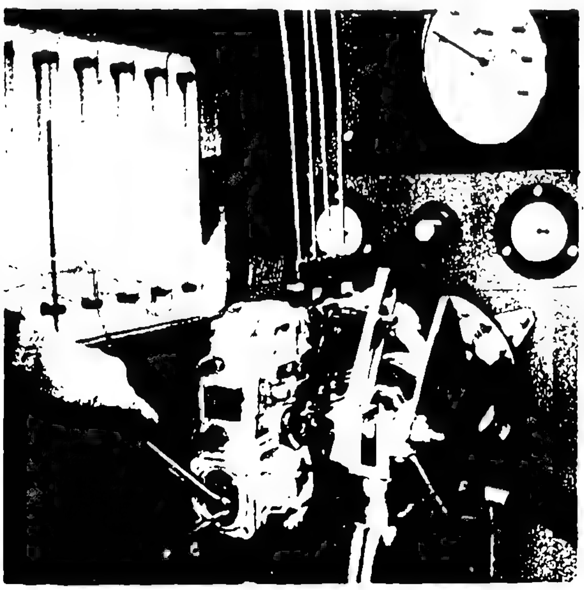


15

B) EINSTELLWERTE DES

1	2	3	4
Obere Nenndrehzahl			Mittlere N
Verstell-hebel-ausschlag Grad	U/min	Regelweg mm	Verstell-hebel-ausschlag Grad
ca. 72	1400 (1)	8,9	
	1400	8,8 - 9,6	
	1420	6,4 - 7,8	
	1450	4,3 - 5,2	
	1500 (5)	1,7 - 3,3	
	1600	0 - 1	

16



17

Idling spring adjustment

Operate the pump at approx. 100 rev/min above idle speed. Move the control lever slowly from shut-off in the direction of full until the control rack moves. Rack travel though must be less than 1.5 mm/0.06 in. Clamp the control lever at this angle.
Set the engine idle speed (according to Column 8, first line).
Screw in the idling spring until specified control rack travel (Column 9, framed value) is reached. Secure the idling spring.
Test the control rack travel at the specified engine speed.

Testing break-away
Test Specifications Sheet, Columns 1 to 3

Test engine speed and control rack travel at the specified control lever deflection.

Fine adjustment:
By correction of control lever position.

Rough adjustment:
By governor spring adjusting screw.

For combination governors:
Additional tests according to Columns 4 through 6.

The lever position may be slightly altered.
Do not alter the rocker, or governor spring tension.

Screw in and lock the engine maximum speed stop screw.

6. Adjusting the Pump and Governor together

Test Specifications Sheet, Section C

Adjusting full-load delivery

Control lever up against the engine maximum speed stop screw. Set engine speed according to Column 1.
Measure fuel delivery.

Note! The initial adjustment of full-load control rack travel according to Figure 9 is the starting point for governor adjustment. In order to achieve the required full-load delivery, a deviation from this starting point may be necessary.

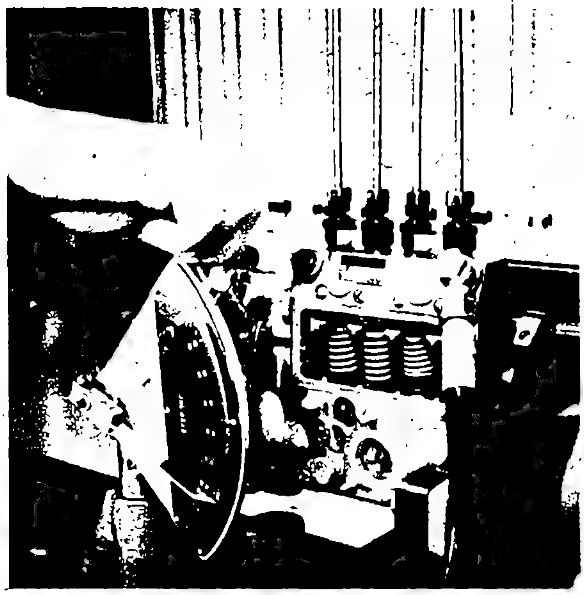
Excessive fuel-delivery
Adjust fuel delivery at the full-load delivery stop.

Inadequate fuel-delivery
Screw the rocker adjusting screw in about 2 - 3 notches. Adjust the fuel delivery at the full-load stop. Adjust the rocker again according to Fig. 11.

WPP00114, N5

Adjusting break-away
Test Specifications Sheet, Column 3

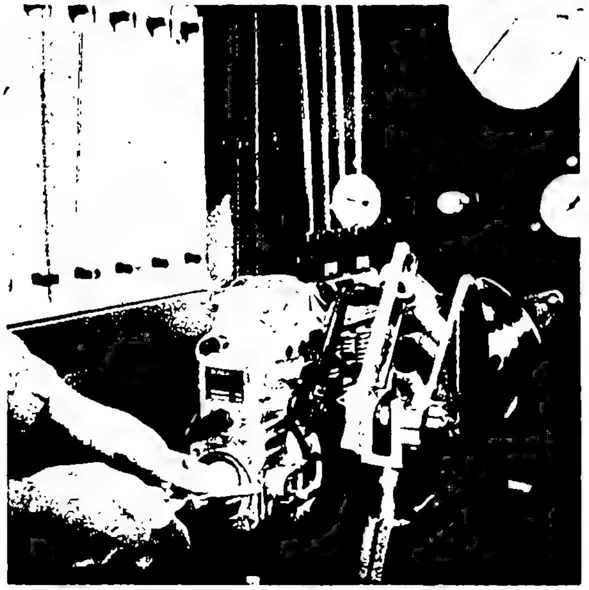
Adjust and tighten the engine maximum speed stop screw accordingly.



18

Testing fuel delivery characteristic
Test Specifications Sheet, Column 4 and 5

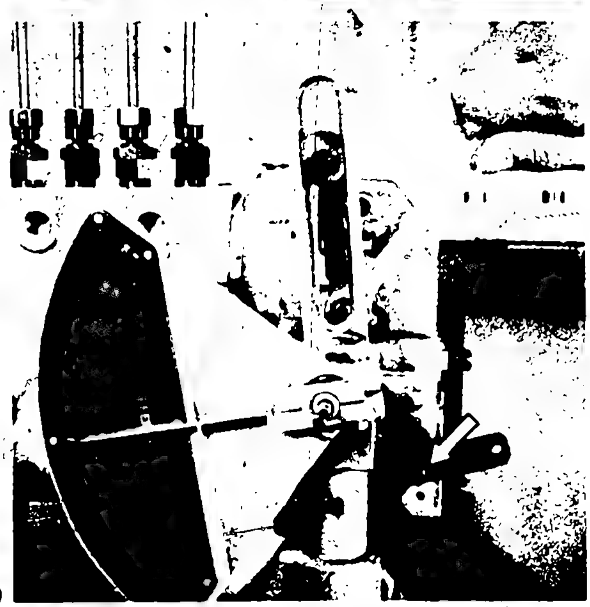
Control lever up against the engine maximum speed stop screw. If necessary, correct the fuel delivery at the torque control capsule.



19

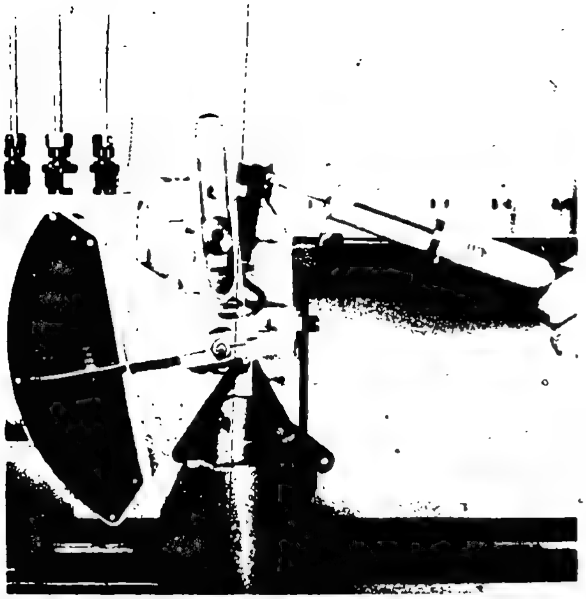
Single-lever operation (special model)

Initial adjustment of intermediate lever
Set the engine speed according to test sheet Section B, Column 8, last line.
Set the control lever for the correct control rack travel (according to Section B, Column 9).
Clamp the angle measuring device at this position.
Turn off the test bench.
With the control lever at this angle fit the intermediate lever up against the stop lever and lock it.



20

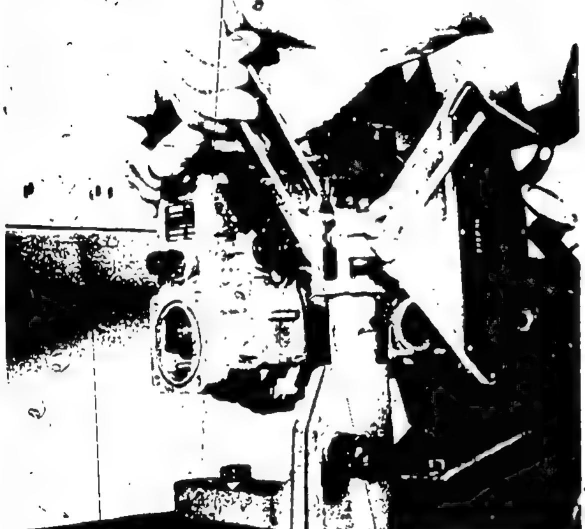
N1



21

Adjusting stop lever eccentric

Remove the connecting pin between the angle measuring device and the control lever. Move the control lever rapidly several times from full to shut-off.
With the spring scale set at 100 mm/3.9 in, pull the control lever (perpendicularly) to shut-off.
Governing force is given in the test sheet (for instance, 7 ± 0.5 kgf).
Turning the eccentric to the right increases the governing force.
Position the intermediate lever again according to Fig. 20.



22

Adjusting shut-off or idling stop screw

Do not operate pump.
Move the control lever rapidly from full to shut-off.
Set the shut-off stop screw for 0.3 to 1 mm (0.012 to 0.039 in) control rack travel and secure with a lock nut.

New Product

PNEUMATIC/ELECTRONIC
IDLE-SPEED INCREASE

40...46,58
VDT-I-420/3 En
11.1985

Depending on vehicle model and equipment, pneumatically controlled idle-speed increase and electronically controlled idle-speed control are being installed for the first time together with a M-pump with RSF II governor in Daimler-Benz.

The pneumatic idle-speed increase is available in 2 versions:
for passenger cars with manual transmission
and for passenger cars with automatic transmission.

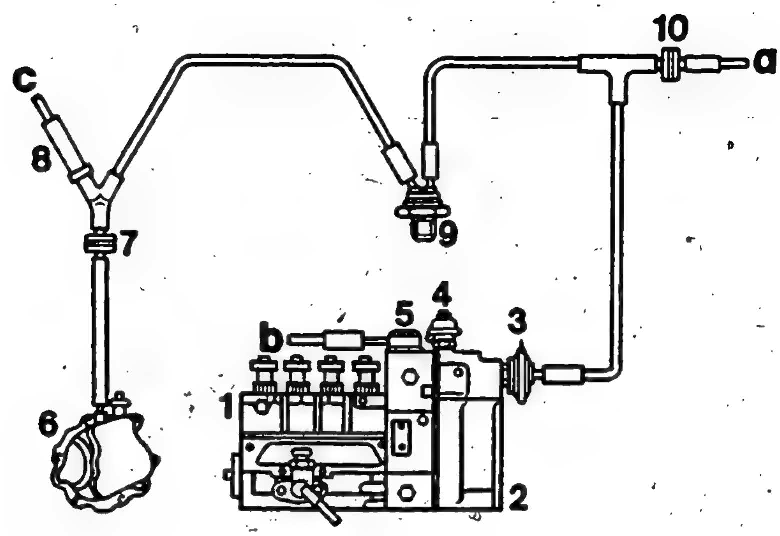
The electronic idle-speed control is installed predominantly in vehicles with air conditioner and automatic transmission.

BOSCH Geschäftsbereich KH. Kundendienst Kraftfahrzeug-Ausrüstung.

N3

Application of pneumatically controlled idle-speed increase

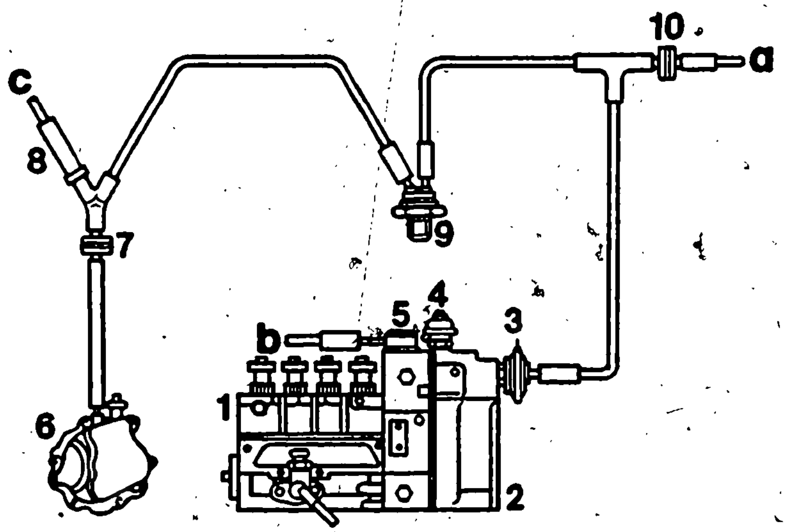
The temperature-dependent pneumatic idle-speed increase raises the idle speed when the engine is cold and improves the warm-up phase.
The idle-speed increase prevents the engine from "dying" when cold when additional loads, such as servo-steering, air conditioner etc., are switched on.
After a certain engine temperature has been obtained, the idle-speed increase is rendered ineffective.



1 = Fuel-injection pump
2 = Governor
3 = Idle-speed increase vacuum unit
4 = Altitude-pressure compensator unit (USA)
5 = Vacuum unit (shutoff)
6 = Vacuum pump
7 = Air-admission filter
8 = Restriction 0.5 mm diameter
9 = Thermo-valve (closes at +30°C)
10 = Air-admission filter

a = Air-admission line
b = Key-operated shutoff
c = Other loads

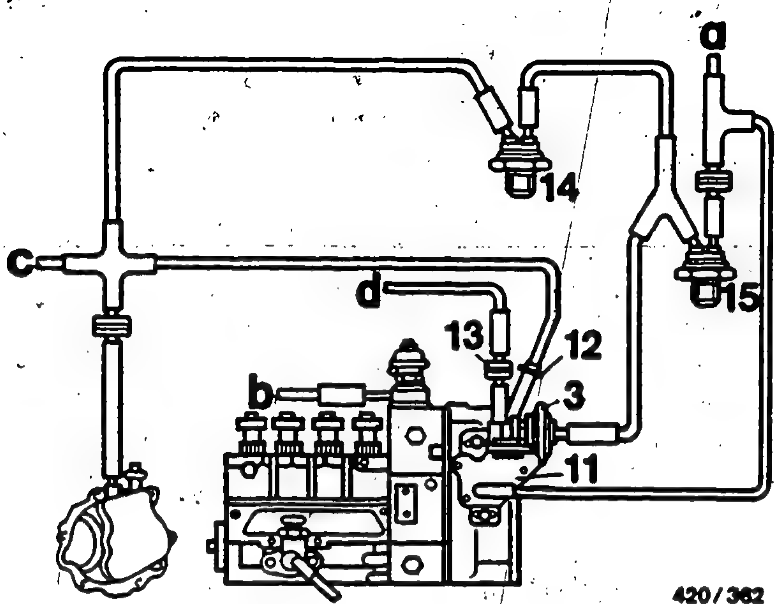
Diagram of lines of pneumatic idle-speed increase for passenger cars with manual transmission.



Functional description of pneumatic idle-speed increase for passenger cars with manual transmission

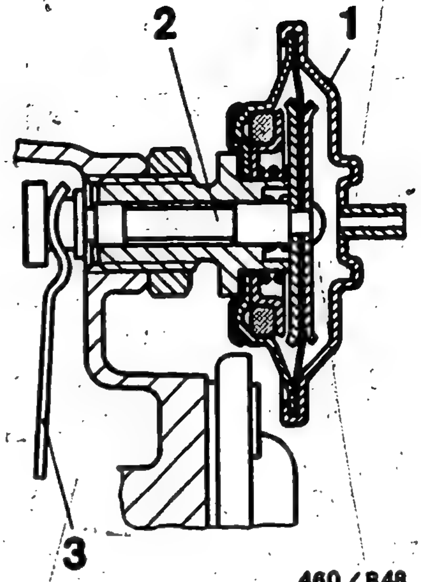
The idle-speed increase is effective at engine temperatures below +30°C when vacuum is applied to the vacuum unit (3). The idle speed is increased. At above +30°C the thermo-valve (9) is closed. Air is admitted to the vacuum unit (3) and the engine speed is no longer increased.

N6



3 = Vacuum unit (idle-speed increase)
11 = Vacuum-control valve
12 = Restriction
13 = Damper
14 = Thermo-valve
15 = Thermo-valve
d = Automatic-transmission vacuum unit

Diagram of lines of pneumatic idle-speed increase for passenger cars with automatic transmission

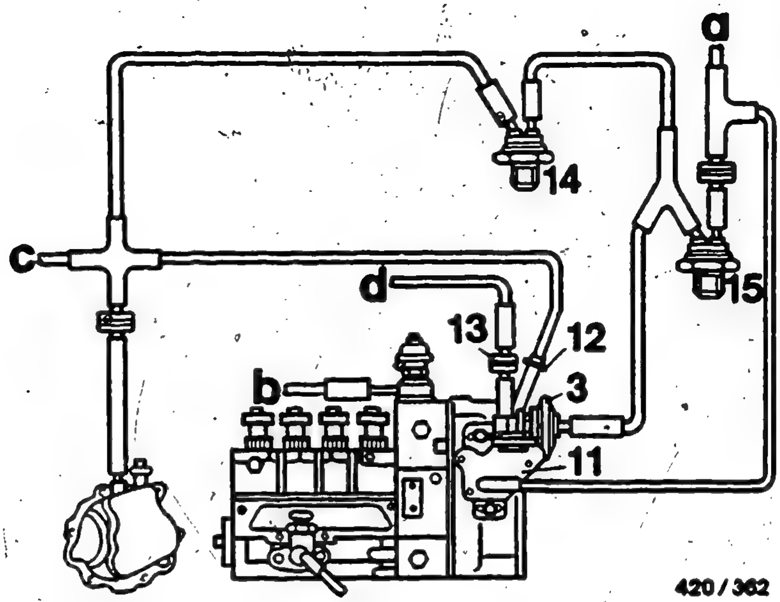


1 = Vacuum unit
2 = Ram
3 = Idle spring

Functional description of pneumatic idle-speed increase for passenger cars with automatic transmission.

The idle-speed increase for stabilizing the engine speed is operative up to approx. +17°C coolant temperature (also above +17°C coolant temperature on vehicles with automatic transmission when the refrigerant compressor is switched on). The vacuum unit on the governor housing is energized by the thermo-valves (14 + 15).

N8



14 = Thermo-valve open below +17°C
15 = Thermo-valve open above +17°C

When vacuum (approx. 500 mbar) is applied to the vacuum unit, the idle spring is pulled in by a ram. This shifts the idle characteristic, i.e. the idle speed is raised by approx. 100 min^{-1}.
At coolant temperatures below approx. +17°C thermo-valve (14) is open and thermo-valve (15) is closed. The vacuum is thus applied to vacuum unit. The idle speed is raised.

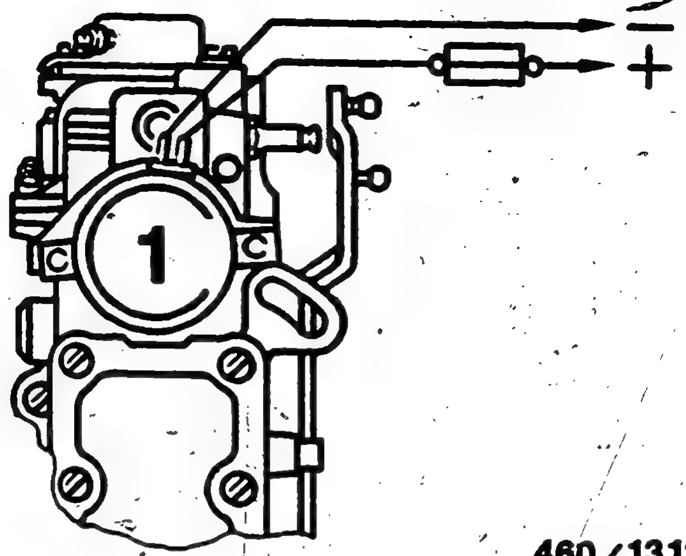
At coolant temperatures above approx. +17°C thermo-valve (14) is closed and thermo-valve (15) is open. Air is admitted to the vacuum unit and the engine speed is no longer raised.

Application of electronically controlled idle-speed control

The electronic idle-speed control is a system which is added onto the mechanical governor.
Consequently, the idle speed is kept constant irrespective of load.

The electronic idle-speed control consists of the following components:

- Servo-magnet
- Engine-speed sensor
- Temperature sensor
- Electronic control unit
- Overvoltage protection unit.



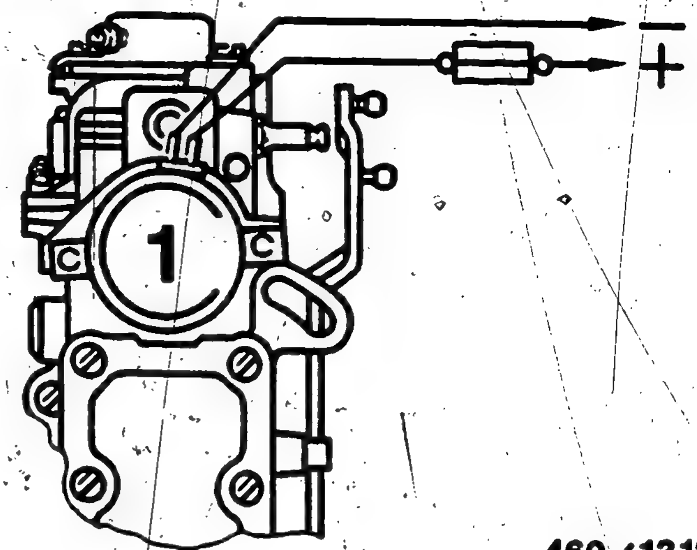
460/1312

1 = Servo-magnet

5.1 Functional description of electronic idle-speed control

The engine-speed sensor measures the engine speed (144 pulses/revolution) and relays this in the form of an AC voltage to the control unit.

The control unit of the idle-speed control system receives the reshaped engine-speed signal, performs a comparison between setpoint and actual values, and transmits appropriate pulses to the servo-magnet on the fuel-injection pump.



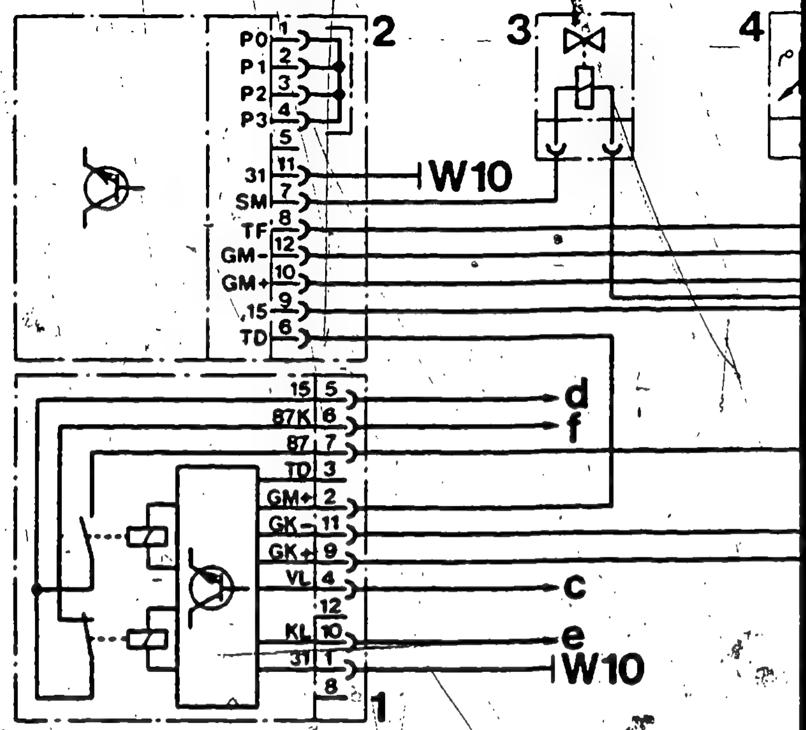
460/1312

1 = Servo-magnet

The armature of the servo-magnet presses on the guide lever in the governor.

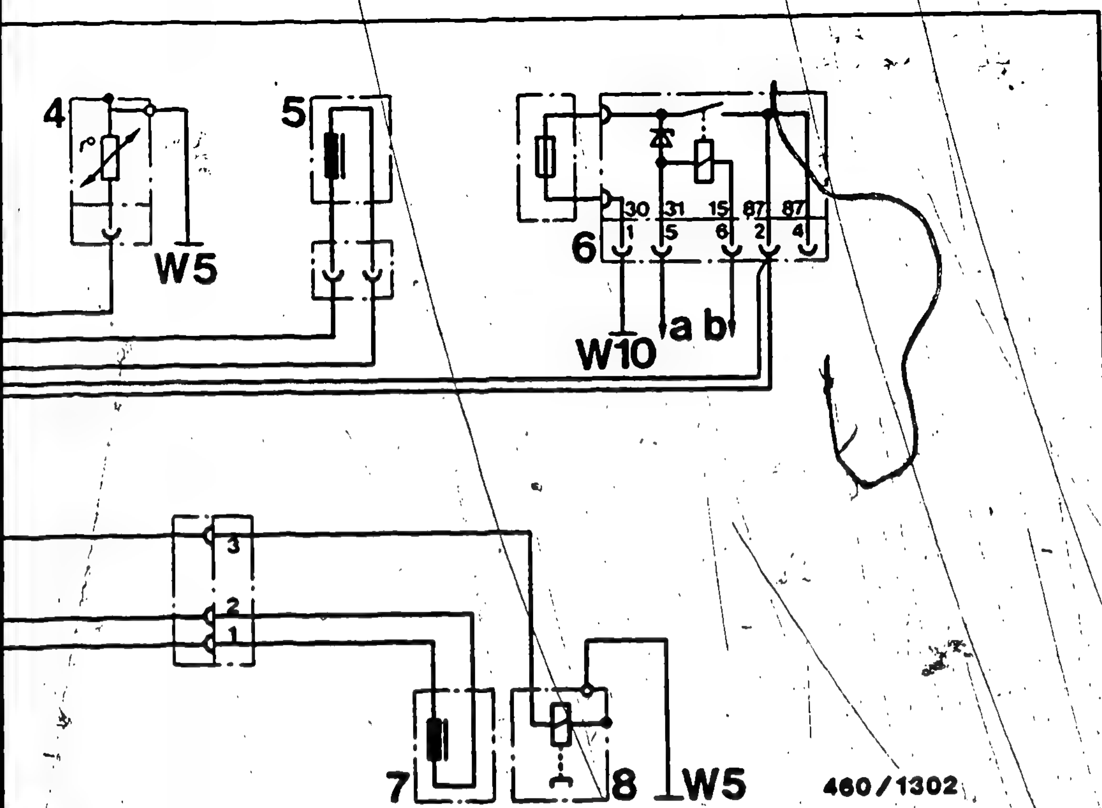
Consequently, the idle speed is kept constant irrespective of the load on the engine.

At coolant temperatures below +60°C, the temperature sensor ensures that the idle-speed setpoint is raised in accordance with a preset characteristic.



1 = Refrigerant-compressor control unit
2 = Control unit of idle-speed control
3 = Injection-pump servo-magnet
4 = Coolant temperature sensor
5 = Engine-speed sensor
6 = Overvoltage protection unit
7 = Refrigerant-compressor engine-speed sensor
8 = Refrigerant-compressor electromagnetic clutch

Circuit diagram of electronic idle-speed control for vehicles w



a = Engine plug connector, 12-pin socket 1 (Term. 15)
b = Engine cable connector term. 30
c = Microswitch socket 3
d = Series resistor auxiliary fan double-contact relay socket 4 Term. 86
e = Refrigerant-compressor pressure switch
f = Engine compartment plug connector 12-pin, socket 9
W5 = Engine ground
W10 = Battery ground

<u>...hicles with automatic transmission and air conditioner.</u>

New Product

Mechanical governor
0 420 021.. – RSF .. M ..

VDT-I-420/1 En
1.1979

In new passenger cars from Mercedes-Benz, the familiar Bosch diesel fuel-injection pump, size **M**, is being fitted with the newly developed **RSF** mechanical governor.

1. Governor designation

R S F XXX/XXXX M XX

- XX – Model number
- M – Size letter, for fitting on M-size fuel-injection pumps
- XXXX – Maximum speed
- XXX – Idle speed
- F – Governor for vehicle applications
- S – Helical compression spring
- R – Mechanical governor

2. Functional description

The **RSF** mechanical governor is a minimum-maximum-speed governor.

This type of governor governs the idle and the maximum speed. In the part-load range, the driver "governs" by means of the accelerator pedal.

Features:

All adjustments can easily be carried out from the governor-cover side.

Pneumatic shutoff controlled by the ignition lock.

The governor can be fitted with add-on equipment for modification of its characteristic curve (altitude compensation, manifold-pressure compensator, etc.).

BOSCH Geschaftsbereich KH Kundendienst Kfz-Ausrustung

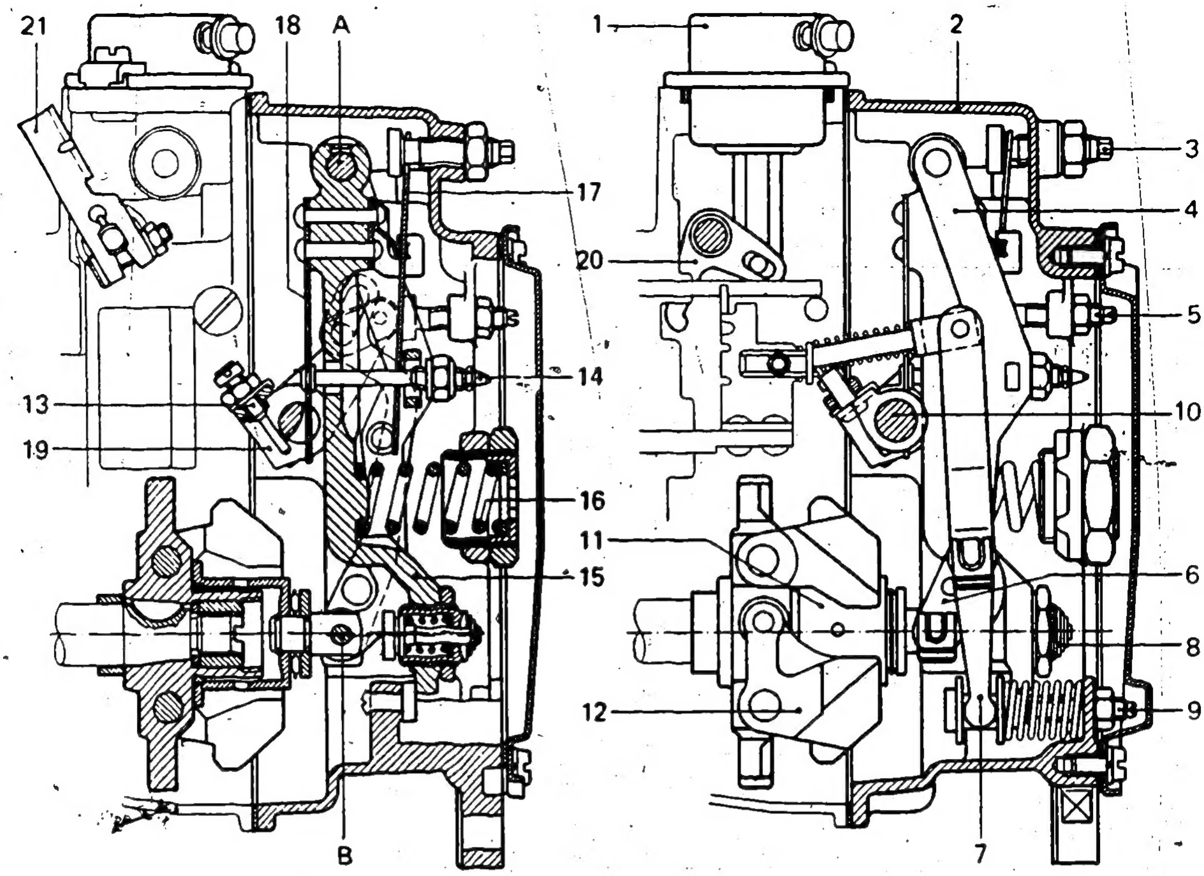


Fig. 1

1 = Pneumatic shutoff box (PNAB)
2 = Governor cover
3 = Idle stop screw
4 = Guide lever
5 = Stop screw for idle quantity
6 = Reverse transfer lever
7 = Fulcrum lever
8 = Spring retainer (torque control)
9 = Full-load stop screw
10 = Control lever
11 = Sliding sleeve
12 = Flyweights
13 = Idle-speed auxiliary spring shutoff
14 = Adjusting screw for idle-speed auxiliary spring
15 = Tensioning lever
16 = Governor spring
17 = Idle spring
18 = Idle-speed auxiliary spring
19 = Linkage lever
20 = Stop lever
21 = Clamping lever

2.1 Sub-assemblies

The flyweight assembly (12) is directly secured to the camshaft.

When the flyweights pivot outwards (12), the sliding sleeve (11) is shifted in the axial direction.

The reverse transfer lever (6) and the guide lever (4) can move and are connected by means of a pin to the sliding sleeve (11) at the Point B.

The fulcrum lever (7) can turn in the full-load stop screw (9) and is connected by a pin with the reverse transfer lever (6).

The injection pump control rod is connected through a strap with a cushioning spring to the fulcrum lever (7).

The control lever (10) is connected to the reverse transfer lever (6) through the linkage lever (19).

The tensioning lever (15) and the guide lever (4) pivot around the pivot point A.

The idle-speed auxiliary spring (18) is rigidly fixed to the tensioning lever (15).

The idle-speed spring (17) is hooked into a strap of the control lever and is supported on the guide lever (4).

The idle spring (17) is pretensioned by the adjusting screw (3).

1-42011

2.2 Governing action during start and full load

If the control lever (10) is pushed up against the full-load stop in the governor housing when the engine is switched off, the reverse transfer lever (6) pivots around the pivot point **B** and moves the fulcrum lever (7) in the **Start** direction.

In the full-load position of the control lever (10) ("full-throttle"), the idle-speed auxiliary spring (18) is pushed away from the guide lever (4) by the idle-speed auxiliary spring shutoff (13).

This facilitates a more rapid speed regulation out of the start position of the governor.

After completion of the idle stage, the sliding sleeve (11) contacts the spring retainer (8). This causes the injection pump control rod to move to the full-load position through the action of the reverse transfer lever (6) and the fulcrum lever (7).

When a certain speed has been reached, the spring retainer (8) is compressed by a certain amount (torque control).

If the engine speed continues to increase, the fly-weight force is sufficient to overcome the governor spring (16) (full-load speed regulation).

Breakaway is dependent upon the pretension of the governor spring (16).

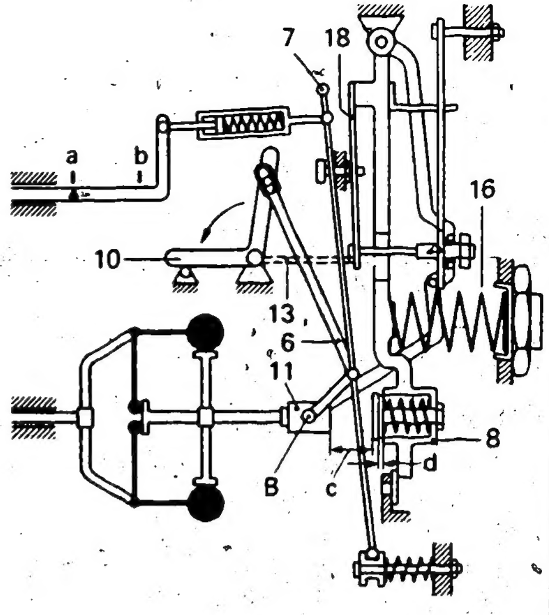


Fig. 2

a = Start
b = Stop
c = Idle stage
d = Torque control

2.3 Governing action at idle

The linkage lever (19) contacts the idle stop screw (5).

With increasing speed, the sliding sleeve (11) passes through the idle stage.

The guide lever (4) pivots around pivot point **A** and acts in opposition to the idle spring (17).

When a certain speed has been reached, the guide lever (4) contacts the adjusting screw of the idle-speed auxiliary screw (18).

The movement of the sliding sleeve (11) is transmitted, in the same sense of direction, to the injection-pump control lever through the reverse transfer lever (6) and the fulcrum lever (7).

After completion of the idle stage, the sliding sleeve (11) contacts the spring retainer (8).

If the engine speed increases further, for instance during overrun, then, above a certain speed, the spring retainer is overcome and then the governor spring.

This moves the control rod to the **stop position.**

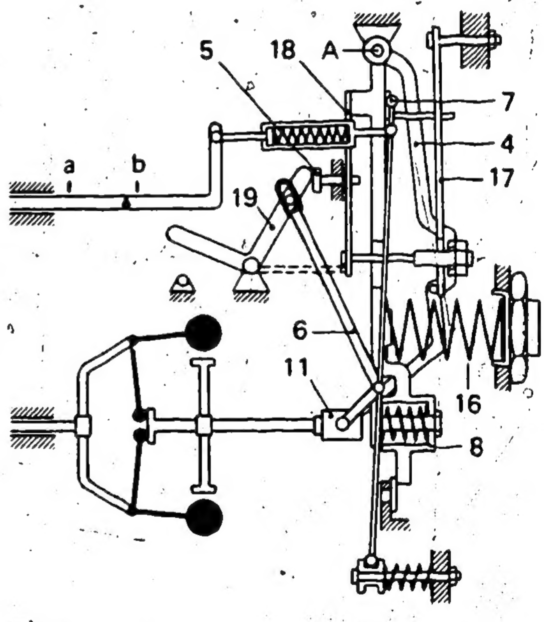


Fig. 3

a = Start
b = Stop

N17

2.4 Governor stop-position

The vacuum pump is switched on by the ignition lock and applies vacuum to the pneumatic shutoff box (1).

This causes the diaphragm of the shutoff box to be pulled up against the force of the compression spring.

The pneumatic shutoff box (1) is connected with the stop lever (20).

This pivots around the pivot point **D** and in doing so pulls the injection-pump control rod into the **Stop position**. The cushioning spring in the fulcrum lever is overcome in the process.

Using the clamping lever (21), the control lever can, in a similar manner, be pulled into the Stop position from outside the governor.

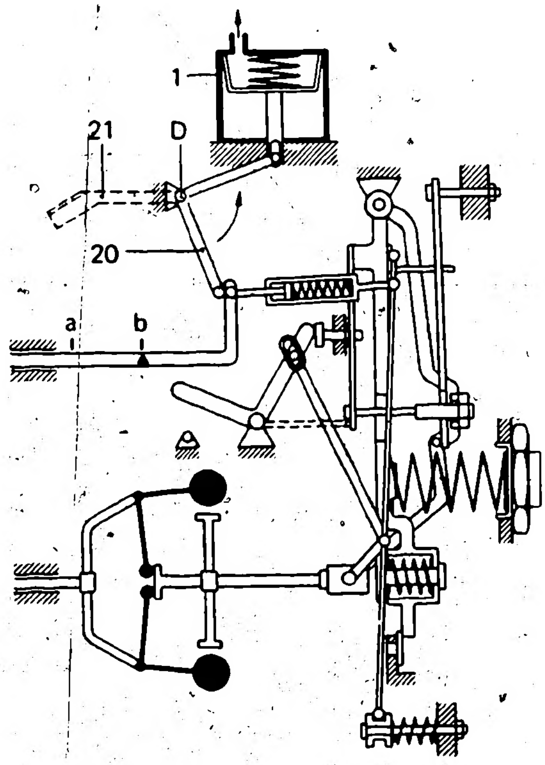


Fig. 4

a = Start
b = Stop